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SANITATION HANDBOOK

OF

CONSUMER PROTECTION

PROGRAMS

UNITED STATES DEPARTMENT OF AGRICULTURE

CONSUMER AND MARKETING SERVICE

PREFACE

This handbook was prepared by meat inspection specialists of the United States Department of Agriculture's Consumer and Marketing Service to be used as a tool by those concerned with the sanitary processing of meat and meat products. It brings together the sanitation guidelines to be followed in all meat plants producing meat under Federal inspection.

This handbook is designed primarily for C&MS meat inspectors, but may also be used by inspectors in plants operating under State or municipal meat inspection programs. It serves as a reference for inspectors in both understanding and carrying out their sanitation responsibilities. Plant management personnel in both foreign and domestic meat plants may also find it helpful in understanding the scope and application of sanitation in the production of wholesome meat products.

The "Sanitation Handbook" should be used in conjunction with the "Manual of Meat Inspection Procedures of the United States Department of Agriculture" and "The Regulations Governing the Meat Inspection of the United States Department of Agriculture."

CONTENTS

CHAPTER I

INSPECTOR'S ROLE IN SANITATION

One of the most vital aspects of the inspector's job is that of sanitation. However, both the plant management and the inspector have specific sanitation responsibilities which should not be assumed by the other. The plant management should not view the inspector as an additional foreman, sanitation supervisor or quality control supervisor. Likewise, the inspector should not feel his presence and influence is not needed in those plants or situations where a good sanitation program exists. The inspector must see that the plant management assumes its responsibilities to produce a clean product in a clean plant, utilizing sound hygienic procedures.

The following are some qualities an inspector must have in order to be effective in his sanitation responsibilities:

Knowledge

The more knowledge an inspector has, the more effective he can be.

The inspector should acquire a basic understanding of why good sanitation is so vital. Being prepared and able to explain the "whys" of sanitation go a long way toward being an effective inspector. This handbook is designed to be the inspectors primary source of information about plant sanitation.

The inspector should know the industry and its operational procedures. This includes the cleaning procedures used on equipment within the plant. The better an inspector knows the industry, the better and easier his job will be.

It is important to know not only what can be done, but also what cannot be done.

Standards and requirements change as new knowledge and procedures are introduced.

An inspectors knowledge is obsolete in a short time unless he makes a conscientious and concerted effort to keep current. He should accept the responsibility of keeping himself informed.

Example

In many mass production situations, workers can easily lose sight of the end result or purpose of their work.

In the case of food processing, the worker may no longer view the product being handled as an article of human food. This is a

dangerous attitude that can lead to a complete breakdown of sanitation standards.

The inspector must not only guard against this attitude himself, but must serve as an example of the best in personal hygiene, dress, and methods of handling food products.

The inspector must be clean and look clean. Often he sets the sanitation pace for the plant or department. Since he is considered an expert in hygiene, it is highly unlikely that hygiene standards of plant workers will exceed those practiced and exemplified by the inspector.

Attitude

The inspector should be consistent from day to day and from plant to plant. The same sanitary standards must be applied with equal fairness to all plants.

The inspector should have a courteous, considerate and patient approach, but be firm in his insistance on meeting reasonable sanitary requirements.

Judgment

Judgment is the ability to choose a just or wise action based on conclusions drawn from the circumstances presented. No matter how it is defined, good judgment is an essential element of good inspection.

There are too few clear-cut formulas or universal standards to go by; thus, inspectors must cultivate and develop the ability to make good decisions based on sound reasoning.

CHAPTER II

PLANT MANAGEMENT RESPONSIBILITIES

When Federal meat inspection is granted to an establishment, a responsible plant official signs a statement agreeing to conform strictly to all Federal regulations and orders pertaining to meat inspection and actually guarantees that the plant will be maintained in a sanitary condition.

This statement emphatically establishes that plant management has the responsibility to produce clean product in a clean plant under good hygienic conditions. This also includes cooperating with the inspector and providing information necessary for him to do a proper inspection job.

Each plant or department should have a competent individual assigned to be responsible for sanitation. His responsibilities must include an inspection of the plant or department to insure the clean up was proper and effective prior to the start of operations.

CHAPTER III

SANITATION INSPECTION

Sanitation is everybody's job and is not limited to those who have departmental or plant responsibility. All inspectors whose work involves plant assignments are sanitation inspectors. All inspectors on duty are responsible for sanitation inspection while operations are in progress.

It is also the duty of each inspector to keep his supervisor informed. It is very advantageous for the supervisor to have advance information when a plant protest or complaint is likely to occur. This will enable the inspector and supervisor to work as a team.

The supervisor should be contacted when there are areas of doubt or problems with which the inspector may need assistance. The supervisor is also interested in problems that may have significance in other departments or plants, as well as situations where the inspector has achieved unusually good results.

Pre-operations Inspection

When the C&MS inspector arrives for his pre-operations sanitation inspection, his job is to determine if the plant has fulfilled its responsibility.

Since the inspector cannot examine everything each day, he should spend his time trying to determine the overall acceptability of the clean up by looking at key spots, such as product-contact zones and difficult-to-clean areas. He should examine machinery or areas most likely to be poorly cleaned. Dismantled equipment and pipelines should not be assembled for use until there has been an opportunity for inspection.

The inspector's time is very valuable and should not be wasted in inspecting large numbers of one item such as buckets, pans, trucks, etc. A representative number of individual pieces should be carefully examined, and the determination to accept or reject all such items should be made on that basis.

Segregation of the clean from the dirty is the establishment's--not the inspector's--responsibility.

Pre-operations sanitation inspection affords one of the few opportunities to observe the inner surfaces of dismantled equipment and to make an overall judgement as to the effectiveness of the plant's clean-up operations.

To conduct pre-operations sanitation inspection, the inspector needs to be equipped with a good flashlight, and pencil, U. S. Retained and U. S. Reject tags, string, a clean cloth or paper towel, and a pocket knife, spatula or

or similar probe or scraping instrument.

The inspector should plan his overall schedule and avoid the haphazard approach. Also, the inspector's effectiveness can be increased by avoiding set patterns and definite time schedules.

Operational Inspection

Basically, operational sanitation inspection consists of three general areas:

A. Product handling which includes such items as sanitary dressing procedure, equipment sterilization, handwashing, etc.

B. Housekeeping sanitation such as floor cleaning, trash removal, control of smoking and spitting, prevention of unnecessary accumulation of bones and scraps, etc.

C. Detection of potential problems that will need attention before the next operations begin or be programmed for cleaning, repair, maintenance or replacement.

Inspection Priorities

The chief concern of sanitation is the protection of product from contamination; therefore, to set up priorities one must give the product primary consideration. Based on the relative importance of different types of contamination, the inspector must establish priorities. Through the use of good judgment, the inspector must learn to determine what represents the attention to the obscure.

The following categories are given as general guidelines which should be helpful to all who are concerned with the production of clean product:

A. Direct Product Contamination

This is the most critical category and represents any situation that results in direct contamination of product. These situations require immediate and effective correction. In inspecting equipment, the most critical surfaces are those that routinely contact product, directly or indirectly, during the normal course of operation (i.e., hand tools, knives, saws, cutting boards, table tops, inside surfaces of trucks, choppers, grinders, and other equipment, workers hands, surfaces handled by workers who alternately handle product, etc.)

These areas must be absolutely clean before operations involving their use begin. "Clean" in this instance is defined as free from all foreign material such as meat scraps, fat, rust, dust, blood, manure, lubricating grease, cleaning compounds, scale, etc. It must look clean, feel clean and smell clean. Although no microbiological standards have been established by C&MS for equipment surfaces directly contacting product, these surfaces should be clean by procedures designed to reduce to a minimum or eliminate bacterial contamination. The presence of any visible debris can reasonably be assumed to be a source of bacterial contamination.

B. Possible Product Contamination

Included in this category are areas or surfaces which have a reasonable possibility of product contact through the course of normal operations. Some examples include certain doorways and posts; smoketrees; workers clothing; outside surfaces of buckets, trucks and other equipment; rail switch pulls, etc.

These areas must meet the same standards of cleanliness outlined above, but are usually considered secondary to those in category A. Some of these items can be corrected while production is in progress.

C. Potential Product Contamination

These are areas or surfaces that could potentially contact product directly or indirectly, usually through accidental happenings. Some examples include floors, certain walls, rails, underside of trucks, tables, platforms, etc. Usually these are the areas that can be pointed out and cleaned before the next day's operations and programmed for periodic maintenance and cleaning.

D. Remote Product Contamination

These are areas or surfaces very unlikely to constitute a direct hazard to product but nonetheless must be cleaned (i.e., wall behind a large piece of equipment, etc.). These problems can and should be corrected through a long range sanitation program of established periodic cleaning and maintenance (i.e., stuffer piston pulling, vacuum line cleaning, window cleaning, rail cleaning, etc.).

These divisions are very relative and it is difficult to make absolute categories as the degree of uncleanliness is very important. A grossly dirty item in the last category could become the first category in importance.

For example, a rail can become so dirty and rusty as to be a source of direct product contamination, but it must be remembered it didn't get that way overnight and should have been detected as a potential problem and corrected through the long or medium ranged cleaning and maintenance programs.

Rails as well as any other area in the plant must be scheduled for maintenance and cleaning as often as necessary to provide adequate product protection, whether this be on a daily, weekly, monthly or other routine basis.

A good job in sanitation eliminates all sources of direct product contamination and most, if not all, sources of possible contamination. Daily, weekly, or other periodic cleaning should be programmed for potential sources of contamination. Sources of remote contamination should be programmed for correction on a long-term basis.

Since the inspector cannot observe the operations all the time, he must develop some means of being assured that good sanitation occurs when he is absent as well as when he is present.

Good sanitation is no accident. It must be planned and become an integral part of the plant's operation.

CHAPTER IV

DEVELOPING A SANITATION PROGRAM

Developing a good sanitation program is difficult, but trying to produce clean products without it is even more difficult. The following is a suggested four-step approach to developing a good working program:

Survey of Needs

This is not the purpose of the pre-operations sanitation inspection although this inspection can be helpful in identifying needs. Plant management needs to become aware of the existing sanitation situation. What are the defects and the likely consequences of these defects? Specific detailed cleaning and sanitary maintenance instructions are needed for all equipment and areas.

Establish a Working Program

This is the determination of what is to be done, how it is to be done, and who is to do it.

A. Top plant management must give the support and authority necessary to carry out the program if it is to succeed. Too often the job of clean-up foreman or supervisor is one of low priority and is poorly regarded by plant supervision and thus the man himself. Meat plant sanitation is a complex and difficult job requiring trained capable individuals.

B. The program must be economically feasible. This is where good plant and equipment design and construction pay big dividends.

Good quality, properly constructed equipment can be a significant factor in reducing cleaning costs. The exessive costs relating to sanitation are usually due to a misuse and wasting of costly supplies and improper use of labor. The idea behind this costly idea is that, "if a little will do it, a lot more ought to be better."

Effectiveness of the clean-up is not measured by the volume of chemical used or by how many people are assigned to do the work. All too often the response to a sanitation problem is the assignment of additional plant personnel when what really may be needed is the proper equipment design, cleaning agent or technique.

These problems can be reduced through proper training of employees; selection of the most effective and appropriate cleaning and sanitizing agents and equipment; and continuous enlightened plant supervision.

C. Plant management should realize that poor sanitation also has its cost. Poor sanitation can lead to poor product quality that may result in customer complaints and even loss of customers.

Sanitation has a direct bearing on product shelf-life. Poor keeping qualities result in a higher spoilage rate, more returned product, reduced marketing time, etc. -- all of which serve to increase production costs.

Poor sanitation is a definite factor in increasing the likelihood of food poisoning outbreaks which are dangerous and costly. Poor sanitation can also result in production delays and loss of product through condemnation. Although the costs of poor sanitation are sometimes elusive, they are nonetheless very significant and real.

The importance of planning and good routine maintenance cannot be overlooked in a working sanitation program.

A piece of equipment or building structure will undergo gradual deterioration and seldom suddenly wear out or suddenly become unacceptable. A good maintenance program keeps the gradual deterioration in check and prolongs equipment and building life, but eventually these facilities will become unacceptable and need replacement.

Inspectors and plant personnel should be careful to see that standards do not deteriorate along with the equipment or area. Plant management should plan for replacement and, together with the inspector, set goals and replacement dates through mutual understanding.

Educational Program for Operating Personnel

It is plant management's responsibility to see that all involved employees, both old and new, receive adequate training in proper sanitary handling of product and other sanitation procedures. This should include a basic indoctrination on the importance of sanitation to the plant, the consumer and the worker himself.

Evaluation

This is a responsibility of both the plant and the inspector using the following general criteria:

1. Physically clean --- free from visible soil.

2. Chemically clean --- free from cleaning compounds and other chemical residues.

3. Microbiologically clean --- free from pathogenic organisms or undesirable numbers of other organisms and/or residues resulting from their growth.

While the determination of being physically clean can be made through the use of sight, touch, and smell, the other criteria must be used on the basis of a thorough understanding of the cleaning process used and on the judicious use of laboratory aids.

Any effective plant sanitation program should accomplish all three.

CHAPTER V

SUPERVISOR RESPONSIBILITIES

Supervisors help set the pace and create the attitude necessary for good sanitation. Seldom will sanitation standards among inspectors be better than those set by their supervisors.

Supervisors must be consistent with the inspectors and the plants. Setting one standard when dealing with the inspector and a different one when dealing with plant management must be avoided. The same standards apply for all plants and inspectors.

It is important for supervisors to provide backing and praise to inspectors enforcing good sanitation. Nothing discourages an inspector more than for his accomplishments to go unrecognized or to be told what to do and even pushed into action, only to be left embarrassed by a supervisor who does not give solid reasonable support.

This does not mean that all actions of every inspector must be rigidly upheld. Obviously, this is impossible. If strategic retreat is necessary to gain a better approach, the inspector should be aware of this and involved in such a way that does not cause him embarrassment and humiliation.

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CHAPTER VI

THE SANITARY REPORT (FORM MI-455)

The weekly "Sanitation Report" is designed to be an integral part of the inspector's sanitation control. This report serves as a means of making an official daily record of sanitary conditions in a plant or department, along with a notification of plant management and the Officer in Charge.

In the "Sanitation Report" the inspector is able to document sanitation deficiencies on the day observed, along with remarks on the action taken. These remarks are important and should include names of plant management individuals contacted, kind of action taken, and promised dates of correction if a delay is required.

This information constitutes the most effective aspect of the report and is why the "Sanitation Report" is a valuable inspectional tool.

The "Sanitation Report" also provides the supervisor with a record of progress for each individual plant or department and gives continuity to sanitation programs. Newly assigned inspectors can quickly determine problem areas, progress and projected planned improvements. This is particularly important in those situations involving assignment rotations and temporary detail assignments.

The MI-455 is a valuable tool only if it is accurately completed and properly used by the inspector.

FORM MI-4SS (11-1-66) U.S. DEPARTMENT OF AGRICULTURE CONSUMER AND MARKETING SERVICE

SANITATION REPORT

ESTABLISHMENT NAME: Meat Products Company

ESTABLISHMENT NO.: 38

INSTRUCTIONS: Keep original copy in Establishment's Government office; send copy to Officer in Charge; and give one copy to Establishment. Use check mark to indicate acceptable sanitary condition, "N" for items needing improvement, and "U" for unsatisfactory conditions.

INSPECTOR'S SIGNATURE: John Brown

WEEK REPORTED (inclusive dates): Jan. 8-12, 1968

AREA AND ITEMS	SUN.	MON.	TUES.	WED.	THURS.	FRI.	SAT.
SECTION A. OUTSIDE PREMISES:							
1. PENS		✓	✓	U	✓	✓	
2. DOCKS		✓	✓	✓	✓	✓	
3. SURROUNDING AREA		N	N	N	N	N	
SECTION B. SLAUGHTERING DEPARTMENT:							
1. FLOORS, WALLS, CEILINGS, ETC.		N	✓	✓	✓	✓	
2. LAVATORIES AND STERILIZERS		✓	✓	✓	✓	✓	
3. LIGHTING AND VENTILATION		✓	N	✓	✓	✓	
4. WATER SUPPLY		✓	✓	✓	✓	✓	
5. DRAINAGE		✓	✓	✓	✓	✓	
6. EQUIPMENT		U	U	U	U	U	
SECTION C. ALLIED DEPARTMENTS:							
1. FLOORS, WALLS, CEILINGS, ETC.		✓	✓	✓	✓	✓	
2. EQUIPMENT		✓	✓	✓	✓	✓	
3. LIGHTING AND VENTILATION		✓	✓	✓	✓	✓	
4. WATER SUPPLY		✓	✓	✓	✓	✓	
5. DRAINAGE		✓	✓	✓	✓	✓	
SECTION D. PROCESSING DEPARTMENTS:							
1. FLOORS, WALLS, CEILINGS, ETC.		✓	✓	✓	✓	✓	
2. EQUIPMENT		✓	✓	U	✓	✓	
3. LIGHTING AND VENTILATION		✓	✓	✓	✓	✓	
4. WATER SUPPLY		✓	✓	✓	✓	✓	
5. DRAINAGE		✓	✓	✓	✓	✓	

AREA AND ITEMS	SUN.	MON.	TUES	WED.	THURS	FRI.	SAT
SECTION E. WELFARE FACILITIES:							
1. LIGHTING AND VENTILATION		✓	✓	✓	✓	✓	
2. LOCKERS, BENCHES, TABLES, ETC.		✓	✓	✓	✓	✓	
3. HOT WATER SUPPLY		✓	✓	✓	✓	✓	
4. DRAINAGE		✓	✓	✓	✓	✓	
5. TOILETS, SHOWERS		U	✓	✓	✓	✓	
SECTION F. INEDIBLE DEPARTMENT:							
1. EQUIPMENT		✓	✓	✓	✓	✓	
2. FLOORS AND WALLS		✓	✓	✓	✓	✓	
3. HOT WATER SUPPLY		✓	✓	✓	✓	✓	
SECTION G. PERSONNEL:							
1. DRESS		✓	✓	✓	✓	✓	
2. PERSONAL HABITS		✓	✓	✓	✓	✓	
3. DISEASE - HEALTH HAZARD		✓	✓	✓	✓	✓	
SECTION H. GENERAL AND OTHER:							
1. PEST CONTROL		N	N	N	✓	✓	
2. STORAGE		✓	✓	✓	✓	✓	
3. HALLWAYS AND STAIRS		✓	✓	✓	✓	✓	
4. ELEVATORS AND PITS		N	N	N	N	N	
5. Retail Counter		✓	✓	✓	✓	✓	
6.							

REMARKS AND ACTION TAKEN (Refer to item by section and number.)

A(3) See report for Dec. 25-29, 1967

B(1) Blood and manure on wall next to head droppers, Foreman Schultz promised To alert clean-up crew.

B(6) No vacuum breaker on water supply line to new tripe denuder. Foreman Schultz called C+R on 1/8/68 - will install one this weekend.

E(5) Urinal blocked and overflowing on floor. Room rejected until drain was opened and floor cleaned.

H(1) Roaches noted in laundry area. Exterminator called by Supt. Johnsen (1-8) - corrected 1-10-68.

H(4) Pit on trolley elevator dirty. Talked to Ass't Foreman Ed Peterson on 1-8-68. He promised all elevator pits would be cleaned this weekend and are now scheduled for bi-weekly cleaning.

B(3) Light reflectors greasy and dirty. Foreman Schultz promised To alert clean-up crew.

A(1) Pens 7+8 missed on clean-up Rejected Corrected on night clean-up.

D(2) Cutting boards unclean - rejected before use.

CHAPTER VII

OUTSIDE PREMISES

Location of a plant and the sanitation of its outside premises can have a significant effect on the sanitation inside the plant. Meat, as it is handled in the plant, may become exposed to the outside elements through loading docks, doorways, open windows and the passage of workers and visitors in and out of the plant.

The first step in avoiding contamination is to locate slaughtering and processing plants in areas reasonably free of objectionable odors, such as smoke, flying ash, and dust, originating from such sources as refineries, city dumps, chemical plants, sewage disposal plants, dye works and paper pulp mills. All roadways and railroad sidings servicing the plant should be paved or otherwise rendered dustproof.

The public as well as visitors and workers commonly pre-judge the inside of a plant by its exterior appearance. This often neglected area of plant sanitation is an important reason for the poor public image of the packing industry. If for no other reason, public opinion should be sufficient justification for maintaining tidy, unlittered, uncluttered, and clean premises. The image of the packing plant as a food processing establishment certainly is not enhanced if the outsider sees it as a junk yard or public dump. It is difficult to relate such surroundings with modern standards of sanitary production and preparation of food. Also, plant workers will be more prone to follow sound sanitary practices in handling product if they work in a clean environment.

There are some real and potential sanitation hazards as a direct result of poor housekeeping practices on the outside premises. A disorderly, haphazard accumulation of useless materials--such as rusty truck bodies, scrap metal and lumber, and discarded equipment--makes an adequate clean-up of ground surfaces impossible. This produces a ready-made refuge and breeding place for flies, rats and other vermin in addition to trash and dirt being blown about the shipping areas by the wind. The best extermination program cannot be effective, when a ready supply of vermin awaits just outside the plant doors.

Sanitary maintenance of the outside premises is best handled on a long-range continuing program. Suitable containers or facilities must be provided for routine accumulations of scrap materials and discarded equipment items. An appropiate routine removal of the useless material is essential.

Storage of useful materials and equipment must be in an orderly manner on elevated racks at least 12 inches high. This is necessary to permit the routine clean-up of waste and debris from all ground surfaces. Plant

management must instruct maintenance and repair personnel to promptly and properly store useful items in the provided facilities and not permit the utilization of temporary accumulation points. These "temporary" storage areas have a way of growing and becoming permanent.

A good program of grounds maintenance must be established whereby all outside premises are raked and policed periodically and weeds kept under control. Weekly intervals are usually adequate.

Outside burning of plant refuse, such as paper towels, cartons, labeling materials and office waste, frequently can be a sanitation problem. In addition to being a fire hazard, ash, smoke, and partially burned paper may be carried by the wind around the docks, and into the plant if proper incineration facilities are not provided.

Indiscriminate, ground surface burning of refuse is unacceptable and must not be permitted. If local incineration is desired by plant management, acceptable facilities which insure positive control of refuse materials smoke and flying ash must be provided. Unless such approved facilities are present, arrangements must be made for removal of plant refuse on a daily basis or more often if necessary to prevent a nuisance.

CHAPTER VIII

PLANT CONSTRUCTION

Applicants seeking Federal meat inspection must submit for review and approval blueprints or drawings with specifications that fully and clearly illustrate the applicant's plant as it exists or as he proposes to have it modified or constructed and equipped for inspection. This approval by the Technical Services Division of C&MS is necessary prior to granting inspection to determine their adequacy for operating under Federal inspection. When changes are proposed in establishments already under inspection, a similiar process must be followed.

The primary aim in reviewing the drawings and actual facilities is to determine whether the plant operations can be conducted in a sanitary manner. The plans must also provide for the logical, orderly handling and flow of product. The plant buildings and structures must be of a suitable size and construction for their intended purpose to facilitate maintenance and operation. They must provide sufficient space for orderly placement of equipment and storage of material used in any of the operations. They should also provide separation by partition or by location so as to separate those operations which may cause cross-contamination of food products with bacteria, molds, toxic chemicals, filth, or other extraneous and deleterious materials.

Floors, walls, and ceilings in the plant should be constructed to be easy to clean and should be kept clean and in good repair. Fixtures, ducts and pipes should not be suspended over working areas where drip or condensate may contaminate foods, raw materials, label and packaging materials or equipment.

Building Materials

The building materials listed in this handbook represent the United States Department of Agriculture's minimum requirements. Some variations are acceptable, provided the substitutions are equal or exceed the minimum standards. Materials used shall be easy to clean, impervious and resistant to wear and corrosion. Materials that are absorbent and difficult to keep clean (wood, plasterboard, and porous acoustical-type boards, etc.) are generally unacceptable in departments processing food products.

Floors

Floors should be constructed of:

A. Vitrified brick of good quality, bonded with acid-resistant waterproof mortar, and laid on a waterproof concrete base,

B. Dense, acid-resistant waterproof concrete, or

C. Other approved impervious material.

To prevent accidents, excessively smooth floors should be avoided. Floors where operations are conducted should have a nonslip surface. Good results are obtained by using brick or concrete floors with embedded abrasive particles in the surface.

Concrete or mortar floors that incorporate an approved latex or synthetic resin base also have better than ordinary resistance to meat fats and acids.

Floors must be installed and maintained to eliminate all cracks, depressions or other low areas that would accumulate moisture. They should also be properly pitched for efficient drainage. (Specific requirements for floor pitch and drainage are covered elsewhere in this handbook).

Interior Walls

Interior walls should be smooth, flat and constructed of impervious materials such as glazed brick, glazed tile, smooth-surfaced portland cement plaster or other nontoxic, nonabsorbent material applied to a suitable base. Glass blocks used in wall panels must have smooth exposed surfaces and be installed so as to prevent breakage by equipment or carcasses. Suitable sanitary type bumpers should be provided on walls to prevent damage by handtrucks, carcass shanks, and the like.

Window ledges should be sloped about 45° to promote sanitation. To avoid damage to glass in windows the window sills should be 3 feet or more above the floor.

Coves with radii sufficient to promote sanitary practices should be installed at the juncture of floors and walls in all rooms.

Doorways and Doors

*-Doorways should be wide enough to permit product transferred on rails or in handtrucks to pass through without contacting the jambs. A width of five feet is recommended except that $4\frac{1}{2}$ feet is acceptable when used in connection with 11 foot rails.

If frequently contacted by product, doors and door jambs should be clad with rust-resistant metal with tight soldered or welded seams.

The juncture of the door jambs and the walls should be effectively sealed with a flexible sealing compound.-*

Ceilings

Ceilings should be of good height such as 10 feet or more in workrooms.

Ceilings can be an important source of direct product contamination.

Therefore, they must be maintained free of scaling paint or plaster, dust, condensate and leaks at all times. If possible, it is best to avoid painting ceiling surfaces.

Unnecessary overhead structures such as wiring, pipes and hangers not in use, should be removed as they constitute a needless source of potential contamination. A routine cleaning of overhead structures is essential.

So far as structural conditions permit, ceilings shall be smooth and flat. They should be constructed of portland cement plaster, large-size cement asbestos boards with joints sealed with a flexible sealing compound, or other acceptable impervious material. If the ceiling has exposed joists, the joists must be at least 36 inches on center and designed so that there are no excessive ledges or crevices which would be difficult to keep clean.

Interior Woodwork

In those situations where the use of exposed interior woodwork is unavoidable, dressed lumber should be used. The exposed wood surfaces should be painted with either a good grade nontoxic oil or plastic base paint, or treated with hot linseed oil or a clear wood sealer. The latter two treatments are preferred, particularly on ceiling areas.

Stairs

Stairs in departments handling edible product should be of impervious construction with solid treads and closed risers. They should also have side curbs of similar material, measuring 6 inches high at the front edge of the treads.

Screens, Insect Control and Rodent Proofing

The plant and facilities must provide adequate screening and other protection to exclude birds, dogs, cats, and vermin (including, but not limited to insects and rodents).

All windows, doorways, and other openings that would admit insects such as flies shall be equipped with effective insect and rodent screens. Effectively designed and installed "fly chaser" fans and ducts should be provided over doorways in outside walls of food handling areas that are used for shipping or receiving.

Except in the case of solid masonary walls constructed of glazed tile, glazed brick, etc., expanded metal or wire not exceeding ½ inch mesh should be imbedded in walls and floors at their junction. This mesh should extend vertically and horizontally a sufficient distance to exclude the entrance of rats and other rodents.

CHAPTER IX

PLANT LIGHTING

Adequate light is essential to maintain good sanitation. Effective clean-up procedures, acceptable sanitary dressing of carcasses, as well as sanitary practices in all areas of the plant, are extremely unlikely unless abundant light is available. **Contaminants cannot be easily removed if they cannot be seen.**

Adequate lighting must be provided to all areas where food or food ingredients are processed, examined or stored; where equipment and utensils are washed; and to hand washing areas, dressing and locker rooms, and toilet rooms. Light bulbs, fixtures, skylights, or other glass suspended over food in any stage of preparation should be of the safety type or otherwise protected to prevent food contamination, in case of breakage. This can be accomplished by providing a protective shield of suitable nonshattering material such as Plexiglas.

Uncolored glass having a high transmissibility of light should be used in windows and skylights. To reduce glare, light diffusing and heat absorbing glass (blue) may be used in skylights and windows that have considerable sunshine.

The glass area in unrefrigerated workrooms should approximate one-fourth of the floor area of a workroom. This ratio should be increased where there are obstructions such as adjacent buildings, overhead catwalks, or hoists which interfere with the entrance of direct, natural light. At all places where, or at times when adequate natural light is not available or sufficient, well-distributed artificial lighting of good quality is required. This artificial light used must not produce any distortion of color.

The overall intensity of artificial illumination in workrooms should not be less than 20 foot-candles. The illumination should be not less than 50 foot-candles at all places where inspections are made or where special illumination is required to enable establishment employees to properly prepare products of any character to meet the requirements of inspection. In carcass coolers 10 foot-candles illumination at the lower shank level is sufficient.

CHAPTER X

PLANT VENTILATION

Adequate and properly designed ventilating facilities and equipment are closely related to good plant sanitation. Objectionable vapors and odors must be promptly removed so they are not absorbed by exposed product. Also such vapors, including steam, can seriously reduce visibility and otherwise hamper comfort and safety in the workroom.

Therefore, it is important that adequate means for ventilation be provided in all workrooms and welfare rooms. This may be accomplished by means of ventilating-type windows, skylights, or both; or by mechanical means such as air conditioning or a fan-and-duct system. Windows should be the fixed type in locations subject to dust and objectionable odors, such as those adjoining livestock pens, runways, and inedible departments.

A reasonable amount of mechanical ventilation with fresh air must be continuously supplied to prevent stagnation of air in refrigerated workrooms where natural ventilation is limited and where a considerable number of operatives are continuously employed, as in large cutting and boning rooms and bacon-slicing rooms.

Fresh air intakes for workrooms and welfare rooms should be so located that air is not contaminated with odors, dust, smoke, etc. The intakes must be provided with effective filters to eliminate insects, dust, etc. A heating element for tempering the air in cold weather should be provided when needed. Mechanical ventilating systems with the capacity to produce at least six complete air changes hourly should be provided for nonrefrigerated work areas and welfare rooms that depend entirely on artificial means of ventilation.

CHAPTER XI

PLANT REFRIGERATION

Adequate refrigeration is one of the most important means of controlling the growth of microorganisms. It is imperative that sufficient refrigerated space be provided to properly handle carcasses and product.

All perishable product should be handled and stored in areas with a maximum temperature of 50°F. In those situations where compliance has been difficult or impossible to obtain, a thorough washing of the equipment and area is required every 4 hours during the operation.

Each type of refrigeration must be properly installed:

If wall coils are used a drip gutter of concrete or other impervious material united with the floor and properly connected with the drainage system should be provided beneath the coils.

If overhead refrigerating facilities are installed, insulated drip pans properly connected to the drainage system shall be placed beneath them.

Floor-type refrigerating units must be placed within curbed and separately drained areas unless located adjacent to floor drains.

The old-style overhead brine spray refrigerating units must be properly maintained so as to prevent dripping or otherwise contaminating carcasses or product.

CHAPTER XII

PLANT PLUMBING

Plumbing is a particularly important consideration in food plants. If plumbing is improperly installed or maintained, a variety of public health hazards, such as cross-connections, back siphonage, drainage system stoppage, or overhead leakage may occur. Any of these conditions can result in serious contamination of the water supply, product, equipment, or utensils, or create obnoxious odors or other nuisance. Reduced water pressures resulting from improperly sized and maintained pipelines may adversely affect various washing operations and items of equipment which depend upon sufficient pressure and volume to perform their intended functions.

In general, all plumbing should be sized, installed, and maintained in accordance with applicable State and local plumbing laws, ordinances and regulations excepting those situations where C&MS requirements are more stringent.

Plumbing per se involves a variety of areas such as water supply, drainage, and waste disposal. Each of these areas of concern are dealt with separately and include not only plumbing but other sanitary aspects as well.

CHAPTER XIII

PLANT WATER SUPPLY

Potable Water

An adequate supply of fresh clean water is of primary importance in sanitation programs and plant operations. The first requirement is that the water supply in the plant be "potable." This simply means drinkable or safe for human consumption without further treatment such as boiling or adding chemicals.

In general, potability requirements consist of the following general considerations:

A. Physical Characteristics - water should contain no impurity which would cause offense to the sense of sight, taste, or smell.

B. Microbiological Quality - water should not contain any microorganisms that would be a potential threat to human health. Practically all diseases known to be commonly transmitted through water are due to organisms which are discharged through the intestines.

Therefore, in addition to being very offensive, fecal contamination of water represents one of the most dangerous forms of pollution. Since the coliform group of bacteria are universally present in fecal material, laboratory tests for this group gives a direct indication of the numbers of intestinal bacteria present. Thus, the coliform count is the usual measure of water safety.

C. Chemical Characteristics - water should not contain any chemical impurities in concentrations which may be hazardous to the health of consumers. Water should not be excessively corrosive to the supply system. Substances used to treat water should not remain in concentrations greater than required by good practice.

Water should not contain substances that may have a harmful physiological effect or those for which physiological effects are not known.

D. Radioactivity - Exposure of humans to radiation is harmful; therefore, water should not contain radioactive materials.

As a minimum, the plant water supply must pass the tests prescribed for potability in the "Drinking Water Standards" promulgated by the Public Health Service of the U. S. Department of Health, Education and Welfare. Water from any source not approved and certified as potable is automatically deemed non-potable.

- Plant management has the responsibility to see that the water used in the plant is tested periodically by an approved laboratory and be certified as potable by the appropriate local health authority. -

If potable water is supplied from private wells, the wells should be on the premises of the establishment and effectively protected from pollution. The primary consideration in avoiding pollution is construction of the well in such a manner as to prevent the entrance of contaminating material directly from the ground surface or in water that enters the well with insufficient filtration through the soil.

Precautions should normally be taken to insure that no water can enter the well unless it has percolated through at least 10 feet of soil. Wells should be located on higher ground than, and at a safe distance from, sources of pollution such as a septic tank, tile disposal field, livestock pens, and inedible or condemned products handling areas. The distance is usually specified by local health department codes.

If chlorinators are required to assure a continuous potable supply, they should be the automatic type and provided with devices that inform the plant management and inspector when they have ceased to function.

When an approved public water supply is used, annual certification based on samples taken within the plant's distribution system is adequate. Water from private wells requires testing each six months. These are minimum requirements. If at any time the inspector suspects that the plant water supply is unacceptable, rejection of the supply and immediate sampling should take place.

The purpose of water sampling is twofold; first, it is to determine the potability of water as supplied to the plant; and second, it is to determine that there has been no pollution of the water supply within the plant's distribution system.

Since frequent testing is required of water in an approved public water supply, it can usually be accepted into the plant as potable. The chief concern in this case is the possibility of pollution within the plant. Therefore, the certification samples must be taken at various points of distribution in the plant. A single sample taken at the meter is of little or no value as it does not indicate the quality of the water actually included in or used on product.

A careful study of the plant's water distribution system with exploration of possible pollution sources should enable more meaningful samples to be collected.

Generally, samples should be taken in as many different areas of the plant as practical. Possible sources of in-plant pollution include, but are not limited to the following:

A. Non-potable water supply - A non-potable water supply is a potential source of danger. In some plants the supply of potable water is limited and costly and a non-potable supply from a river, lake or unapproved well

is made available. This water may be used in certain restricted areas, but special attention must be given that no cross-connection exists between the potable and non-potable water supplies.

Non-potable water is permitted only in those parts of the plant where no edible product is handled or prepared. Then it is only for limited purposes such as on ammonia condensers not connected with the potable water supply, in vapor lines serving inedible product rendering tanks, in connection with equipment used for washing inedible products preparatory to tanking, and in sewer lines for moving heavy solids in the sewage.

Non-potable water is not permitted for washing floors, areas, or equipment involved in trucking materials to and from edible products departments, nor is it permitted in hog scalding vats, dehairing machines, or vapor lines serving edible product rendering equipment, or for clean-up of shackling pens, bleeding areas, or runways within the slaughtering department.

In all cases, non-potable water lines shall be clearly identified and shall not be cross-connected with the potable water supply lines.

Arrangements can be made for emergency fire fighting connections between the potable and non-potable systems, but a complete break in the piping must routinely exist. Valves alone cannot be used as the means of separations as they may leak or be opened accidently. In each case, such connections must be approved by local authorities and the inspection service.

B. Reuse of Water - There are certain situations where potable water may be reused for the identical original purpose within a plant. Reuse of water may be approved for such purposes as in vapor lines leading from deodorizers used in preparation of lard and similar edible products and in equipment used for chilling of canned product after retorting.

All pipelines, reservoirs, tanks, cooling towers, and like equipment employed in handling the reused water must be constructed and installed as to facilitate their cleaning and inspection. Supply lines for potable water must be so installed as to prevent back siphonage (see item C below).

Complete draining and disposal of the reused water, effective cleaning of the equipment, and renewal with fresh potable water must be accomplished frequently enough to assure an acceptable supply of water for the purpose intended.

The water reused for cooling canned product must be effectively chlorinated (not less than 1 part per million of residual chlorine at any point within the cooling system). It must be emphasized that chlorination alone cannot be relied upon entirely nor is it to be accepted in lieu of the cleaning procedure and disposal schedule of reused water mentioned above.

C. Back Siphonage - Back siphonage is the backflow of used, contaminated or polluted water from a plumbing fixture, equipment or other source into a water supply pipe due to a negative pressure in such pipe or supply system.

The negative pressure or partial vacuum is a potential occurrence in any supply line and may result from such things as clogged pipes; sudden demand for a large quantity of water elsewhere in the system; pump failure; a rupture in the water line (particularly in main lines); placing a demand on the supply line greater than it is designed to carry; etc.

The problem can also be compounded somewhat in multi-story buildings as the force of gravity may add to the intensity of the partial vacuum.

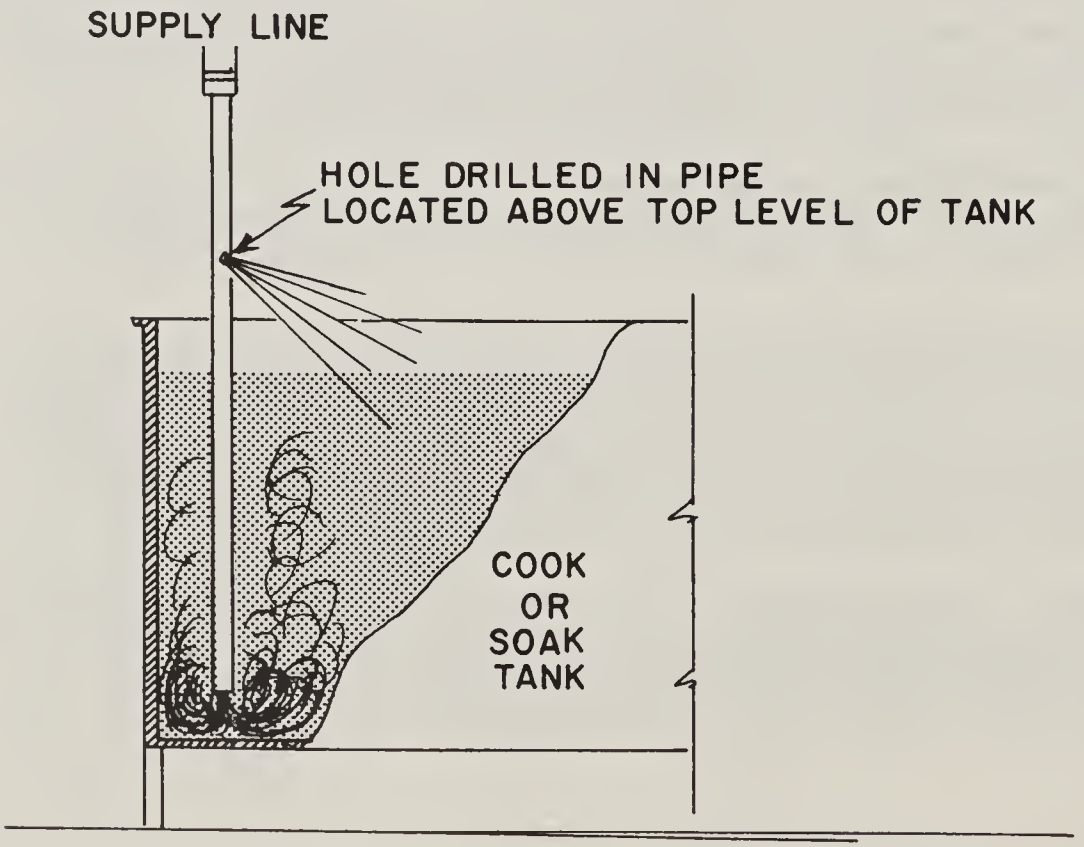
The danger of back siphonage can be prevented through the elimination of submerged water lines or the use of a functional vacuum breaker between the last cutoff valve and the submerged line.

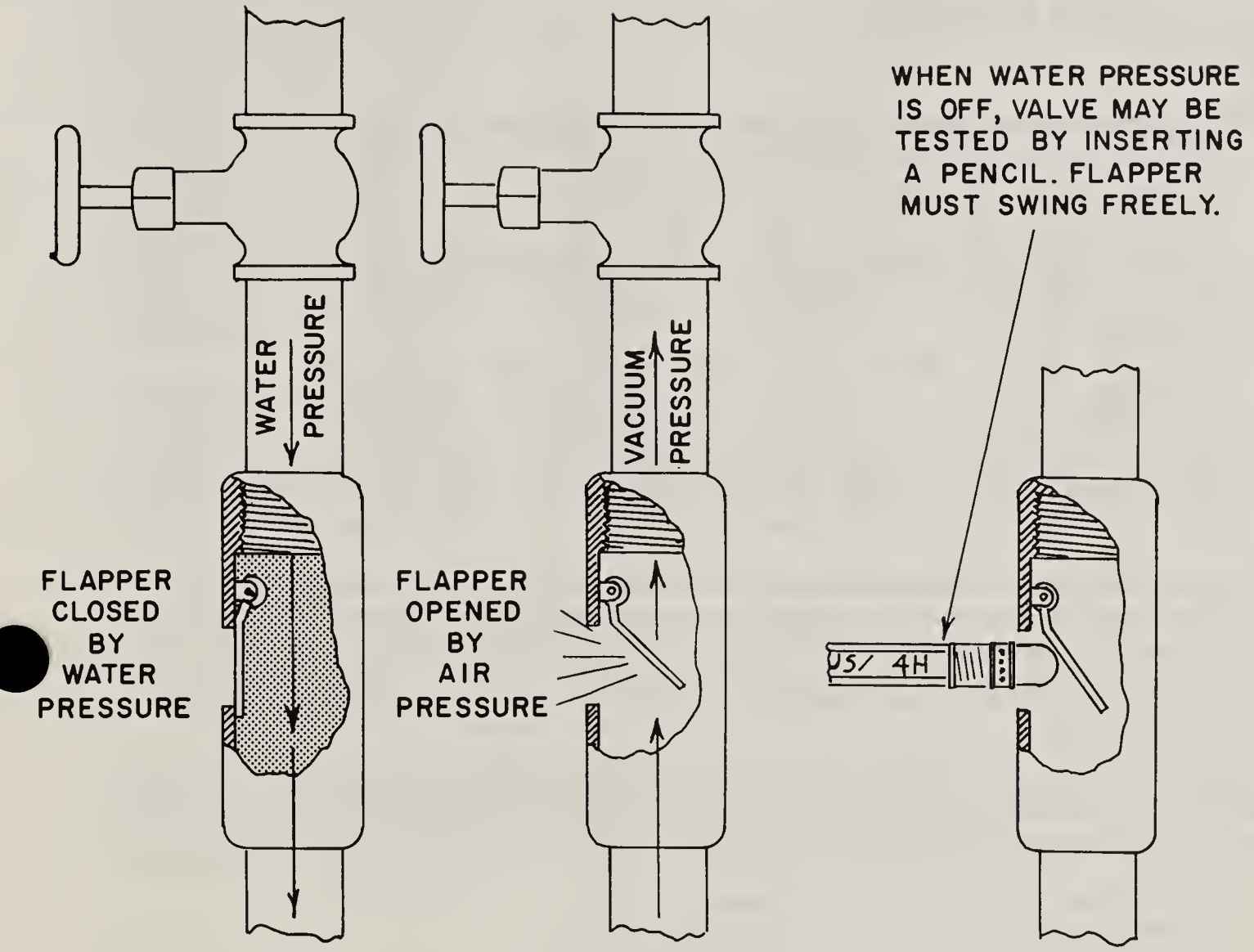
In every place possible, an ample air gap should exist between the water supply pipe and the level to which water or other liquids may intentionally or accidently accumulate. This applies to sinks, lavatories, plumbing fixtures, equipment, storage tanks, etc., and even to clean-up hoses that may be placed in pools of water.

Functional vacuum breakers must be used on installations where submerged water lines are unavoidable (i.e., tripe denuders, defrost tanks, some sterilizers, etc.). A vacuum breaker is a device which will admit air to the water line in the event of a partial vacuum. Since air is much lighter in weight than liquids, it eliminates the sucking of contaminated water into the supply system.

The only vacuum breakers acceptable are those which can continuously be demonstrated to be functional. Attempts to prevent back siphonage through the use of so-called one-way valves, or sealed vacuum breakers cannot be accepted as the sealed mechanism may become clogged or frozen in the open position.

The most simple and effective type of vacuum breaker consists of an open valve or petcock between the cutoff valve and water outlet. When the water is on, there will be a stream of water flowing through this opening.





In systems where a number of identifical submerged lines are used feeding off one main line, a single vacuum breaker placed between the main supply valve and the first submerged line is adequate. An example of this set-up may be a defrost room composed of multiple tanks, each supplied with a water line (illustration).

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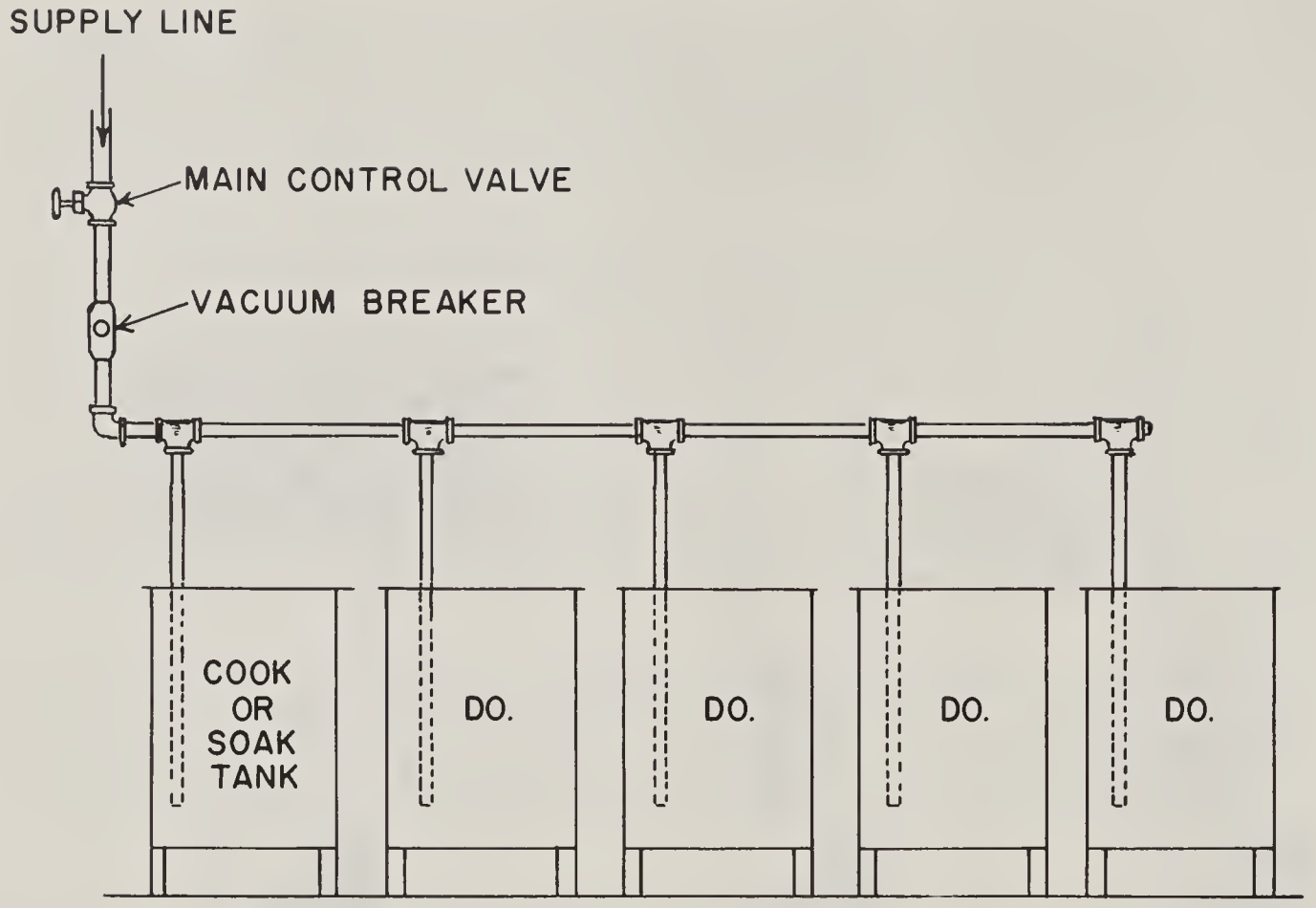


D. Storage Facilities - Facilities for the temporary storage of potable water in the plant must be constructed in such a manner that will prevent contamination of its contents. Open storage tanks are not acceptable.

Storage facilities should be designed so that they contain no dead areas and water must circulate freely and not be allowed to stagnate.

E. Pipelines - The identification of pipelines according to use will aid the inspector in preventing product contamination. The establishment should use the following recommended system:

Fire lines	Red
Sewer lines	Black
Edible Brine lines	Green plus name
Inedible Brine lines	Black
Gas lines	Yellow
Air lines	White
Potable Water lines	Green
Non-potable Water lines	Black
Inedible Product lines	Black plus name
Ammonia lines	Blue
Edible Product lines	Green plus name
Curing Pickle lines	Green plus name

Pipelines should be installed so that dead ends are eliminated. A whole line need not be painted, but a 12 inch band periodically is sifficient. A concerted effort must be made to disconnect and remove water lines no longer in use. These areas that do not have free circulation of water will permit stagnation and a build-up of organisms that constitutes a hazard to the potable water supply.

Contamination of the water supply with rust, scale and grease can occur when old piping or pumps are repaired or disturbed. Serious carcass, product and equipment contamination can result under such circumstances. When such repairs or disturbances occur, the system must be sufficiently flushed to eliminate the contamination hazard.

Hot and Cold Water Outlets

Both hot and cold potable water under sufficient pressure must be provided throughout the plant.

The hot water is to be from a central heating plant of sufficient capacity or from other suitable facilities capable of furnishing an ample supply of hot water. A minimum temperature of 180°F. is required in water used for cleaning equipment, floors, walls, and the like, which are subject to contamination by the dressing or handling of diseased carcasses, their viscera and parts. This temperature requirement is for water at the point of use and when necessary compliance is determined by conveniently installed thermometers.

The mixing of steam and water at outlets is not acceptable for producing hot water used for sterilizing equipment or areas contaminated by diseased material. Hot water used for cleaning rooms, equipment and areas other than mentioned above must be supplied under pressure through conveniently located outlets.

The hot water must be of sufficient temperature to accomplish a thorough clean-up. The use of live steam generally is not an acceptable method of cleaning or sterilizing rooms or equipment. The temperature of steam drops very rapidly after leaving an outlet resulting in practically no cleaning or sterilizing effect.

Steam also has the disadvantage of adding excessive vapors to the area thus limiting visibility and once again reducing cleaning effectiveness. The use of live steam in cleaning and sterilizing can be summarized as a very impressive appearing operation of no real value.

Ice

Ice used in inspected plants must meet the requirements of State and local laws, ordinances and regulations or in the absence thereof, must meet the recommendations of the U. S. Public Health Service as described in, "A Sanitary Standard for Manufactured Ice," Public Health Publication No. 1183 (latest edition).

Ice intended for human consumption or to be used in direct contact with product or with food equipment must meet the same standards of quality required for potable water.

Ice manufactured within the plant must be made from potable water in equipment that can be kept clean and will produce ice of acceptable quality. Storage compartments of "snow-ice," "flake-ice," "pac-ice," and similar equipment should be lined with stainless steel or other rust-resisting metal.

The metal should be of sufficient thickness to withstand repeated striking of a shovel without puncturing.

Suitable perforated, rust-resisting, and removable metal drainage plates should be provided in the bottom of the ice storage compartments, and be frequently inspected to assure their cleanliness.

Some of the equipment used for the production of various forms of flaked ice is so constructed that the water resulting from the melted ice is collected in a space below the ice storage compartment. This water may not be used for the production of ice nor should it be permitted in potable water lines or supply.

There is no objection to prechilling the water intended for the manufacture of ice by circulating it in closed coils submerged in the cold water beneath the storage compartment.

Close inspection of in-plant ice manufacturing equipment is to be a part of the routine sanitation inspection program.

Ice used, but not manufactured in the inspected plant, must be received from approved outside sources. At least annually and whenever requested, plant management is to furnish the inspector a report from the appropriate State municipal or county health agency certifying that the ice being supplied is made from potable water and is handled in a sanitary manner.

Any ice from outside sources other than those so certified, should be rejected.

Vehicles used for transporting or delivering unpackaged ice must be of closed structure with tight fitted covered body, or if of open construction, must have tight floors and sides and should be equipped with clean tarpaulins covering the entire load and reaching all the way to the floor and back of the load.

Ice is to be rejected if the vehicle does not protect it from contamination from dust, dirt or other sources. Ice destined for contact with product or food equipment should be handled in such a manner as to preclude contact with floors or other insanitary surfaces.

Only sanitized utensils should be used in handling edible ice. This applies to manufacture, storage, transport, unloading, and in-plant handling.

Periodic samples of ice are to be taken aseptically and analyzed for bacteriological contamination. Sampling and tests must be conducted by laboratories of the municipal, county, or state government or by a private laboratory certified by the state.

Ice made in the establishment should be sampled at the same time as the water. Twice yearly, ice from outside sources should be sampled and analyzed as received from each manufacturing source. Usual sample analysis is to be at no expense to C&MS.

Water Certification File

It is required that every establishment make known and, whenever required, afford opportunity for inspection of its water supply, the storage facilities, distribution system, and its ice supply. A survey file should be maintained in the inspector's office at each establishment and the circuit office. This file should consist of the following: the general certification that the water supply used at the plant meets the potability requirements; results of periodic water sampling; pertinent information relative to that particular plant (i.e., location of wells, use of non-potable water, special problems or approvals, etc.) record of surveys and inspections made; and records of ice samples and certifications.

CHAPTER XIV

PLANT DRAINAGE

It is important that a plant's drainage systems be designed so that there is prompt removal of fluid and suspended waste. It is considered a serious sanitation hazard to have these contaminated fluids accumulate or flow long distances over floors. The accumulation of wastes creates objectionable odors in working areas and makes proper cleaning impossible thereby considerably increasing the likelihood of product contamination.

For very sound sanitary reasons, a plant must have at least two separate and distinct drainage systems: one consisting of so-called sanitary drainage lines connected to toilet bowls and urinals and the other for general plant waste as from floor drains, lavatories, equipment, etc. Additional drainage systems such as those used solely for blood or solely for paunch or stomach contents are frequently employed in slaughtering establishments.

Sanitary Drainage Lines

Lines from toilets and urinals shall not be connected with any other drainage lines within the plant.

Sanitary drainage must not discharge into a grease catch basin nor shall such drainage be permitted to enter the sewer lines at a point where there might be a possibility of such drainage backing up and flooding the floors of the building. If this positive separation is not maintained, drain back-ups containing human excreta in the production areas would create serious health hazards.

This matter must not escape notice during initial plant construction, evaluation of existing facilities for acceptance as an official establishment or such times as repairs or new installations are made in existing establishments.

Evaluation of existing plumbing systems for this separation is often exceedingly difficult as pipelines may be buried in walls, floors, etc. Reasonable success has been achieved through the use of dyes or other suitable tracers added to the system at various points. Such procedures usually require the skills of trained personnel and assistance can sometimes be obtained from State, municipal or local authorities having such jurisdiction. Also, a reliable plumber hired by the establishment may be able to make this determination.

Sanitary lines must be installed so that if leakage developes it will not effect product or equipment. Such lines should be regularly checked for leakage and immediate correction made of all defects.

In-Plant Drainage

All parts of floors where wet operations are conducted must be well drained. As a general rule, one 4-inch drainage inlet should be provided for each 400 square feet of floor space. A slope of about 1/4-inch per foot to drainage inlets is required for usual conditions.

In areas such as beef sales coolers and other departments where only a limited amount of water is used, the slope may be about 1/8-inch per foot. It is important that floors slope uniformly to drains with no low spots which collect liquid. Floor drains are not required in freezer rooms or dry storage areas.

In certain departments, special floor drainage is required. For example, floor drainage valleys are essential under the dressing rails for hogs, calves, and sheep. Such valleys must be about 24 inches wide and integral with the floor. The valleys must slope at least 1/8-inch per foot to floor drains within the valleys.

In on-the-rail cattle slaughtering departments, floor valleys under the dressing rails are required unless floor drainage is carefully localized with drainage inlets placed advantageously beneath the dressing rails.

Each drain, including blood drains, must be equipped with a deep seal trap (P-, U-, or S- shape) and be properly vented to the outside. The purpose of such traps is to seal off the drainage system so that foul odors (sewer gases) from it cannot enter the plant.

Effectiveness of the trap depends upon enough water remaining to constitute a seal. As water flows through the trap and down the drainpipe, a suction is created that will pull the water out of the trap and break the seal unless the suction is broken by venting the drainpipe (on the effluent side of the trap) to the outside air.

The seal can also be broken by evaporation of trapped water. This does not constitute a problem in frequently used drains but does occur in areas where drains are seldom utilized.

When drains are installed in areas where the water seal in traps is likely to evaporate without replenishment, they are to be provided with suitable removable metal screw plugs. Installations bypassing traps are not permitted.

To prevent drainage lines from becoming entrance ways for rats and mice, all such lines must be equipped with effective rodent screens.

Drain covers in addition to keeping out vermin also serve to prevent blockage of the traps and drainage lines with product scraps or other material too large to flow freely. These drain covers should be secured in place. A loose cover not only will allow rodents to squeeze up through into the rooms, but also constitutes a safety hazard.

Workmen cleaning traps and drains must always replace and fasten the drain covers.

Size and Construction of Drainage Lines

All drainage lines must be of sufficient size to permit a rapid removal of waste. All floor drainage lines must have an inside diameter of at least 4 inches.

Drains for cattle paunch contents should have at least an 8-inch inside diameter to avoid clogging. Drains for hog, sheep, and calf stomach contents must be at least 6 inches in inside diameter. Where several drainage lines discharge into one trunk line, this line must be proportionally larger so as to handle efficiently the drainage discharged into it (it is well to provide for a 50 percent margin of safety).

Drainage lines within the plant must be constructed of cast iron, galvanized metal or copper. They must be installed and maintained in a leakproof manner.

Clean-out fixtures should be located throughout the drainage system so that in case clogging of the sewer should occur, it could be promptly cleaned.

These clean-out fixtures must be placed so that they can be used without constituting a threat of contamination to edible product, and the openings must be so constructed and maintained as to be absolutely leakproof when not in use for cleaning purposes and must be readily accessible.

Drainage of Outside Premises

All parts of the official premises should be sloped and drained sufficiently to permit the quick run-off of all water from plant buildings and of surface water around the plant and on the premises.

Surface and run-off water is usually heavily contaminated and if allowed to accumulate in pools or puddles not only gives rise to offensive odors, but also serves as a breeding place for insects.

Areas around the plant must be properly graded and low places must in all cases be filled in.

Drainage from loading docks must be confined to the immediate area of the dock.

Concrete-paved areas, properly drained and extending out at least 20 feet from buildings, loading docks, or livestock chutes and platforms, must be provided at places where vehicles are loaded or unloaded.

Railroad track gutters with suitable drainage must be provided where refrigerated railroad cars, livestock cars, and tank cars are loaded and unloaded. The top of the gutter must be below the bottom of the railroad ties unless the entire track area is paved.

Drainage Problems

Some frequently encountered drainage problems include: blocked or broken lavatory drains; blocked floor drains, traps and sewer lines; foul odor due to sewer gases resulting from lack of traps, loss of trap seal or by-pass

plumbing around traps; and floor surface deterioration or floor settling creating depressions.

Judgment as to the degree of potential sanitation hazard must be made. Blocked or broken drains and lines and escaping sewer gases require immediate attention. Correction of floor deterioration, cracking and settling may be programmed for early attention.

CHAPTER XV

PLANT WASTE DISPOSAL

In the meat industry, as in many other industries, control and disposal of wastes is a major concern. Optimum utilization and reduction of wastes is an essential goal of economic production in all plants.

In meat plants there often are enormous quantities of wastes which cannot be eliminated and which must be disposed of in a suitable manner. Protection of the nation's limited water resources for maximum use is mutually beneficial to industry, special groups, individual citizens, and the nation as a whole.

In recognition of this fact, industries, government agencies and communities are paying increasing attention to the disposal of wastes in a manner which will not impair the utility of stream waters for other beneficial uses.

From a plant sanitation standpoint, waste disposal has two concerns of vital importance: first is the plant's waste represents most of the contaminants, filth, and disease producing organisms that the sanitation program has eliminated from actual or potential contact with edible product.

It is essential that this material be kept separate and be disposed of in a manner that does not pose a further threat to edible product or human health.

The second is that plant wastes by their very nature have a high nuisance potential. The foul odor and attractiveness to insects and rodents should be obvious justification for sanitary, efficient and safe disposal of wastes.

There are four general categories of plant wastes considered here: 1. Sewage disposal from both the sanitary and plant drainage lines, 2. Grease recovery, 3. Disposal of organic wastes such as paunch contents, hog hair, blood, manure, etc., and 4. Rubbish removal.

Sewage Disposal

The sewage disposal facilities utilized by the plant must be acceptable to the local authorities having jurisdiction over such matters in the area. A letter from the proper authorities is to be on file with the Officer in Charge for each plant under inspection.

The most desirable situation is for the plant sewage to discharge into a municipal sewer system. Due to the frequently enormous amounts of sewage from some plants, this may constitute an undue burden on the municipal system and the plant must make other arrangements with local authorities. In some municipalities as much as 50 to 75 percent of the sewage entering its disposal plant is from meat plant operations.

If a private septic tank or sewage disposal system is used, it must be efficiently designed and operated so as not to produce objectionable conditions on or near the official premises.

It is highly undesirable and unlikely that any untreated sewage from the sanitary lines (toilets and urinals) would be allowed by local authorities to discharge into a stream. However, such disposal of some liquid wastes from the plant drainage may be permitted. In this case, the flow of water must be sufficient at all seasons of the year to carry the sewage well away from the plant.

Catch Basins for Grease Recovery

Liquid wastes from meat plants usually contain large amounts of fat. Reclamation of this fat has certain economic advantages in addition to being a form of preliminary sewage treatment.

Sanitary drainage lines (from toilets and urinals) must not discharge into a catch basin or grease trap, but may join with the effluents of these areas to constitute the total sewage of the plant.

Catch basins are large tanks which receive the plant drainage and allow it to slow down in its flow so that grease and other material may float to the top and be skimmed off and taken to the inedible rendering department (or in some cases, to an outside renderer). Some solid materials settle to the bottom and must be removed periodically during the day to prevent their decomposition or otherwise creating an objectionable condition.

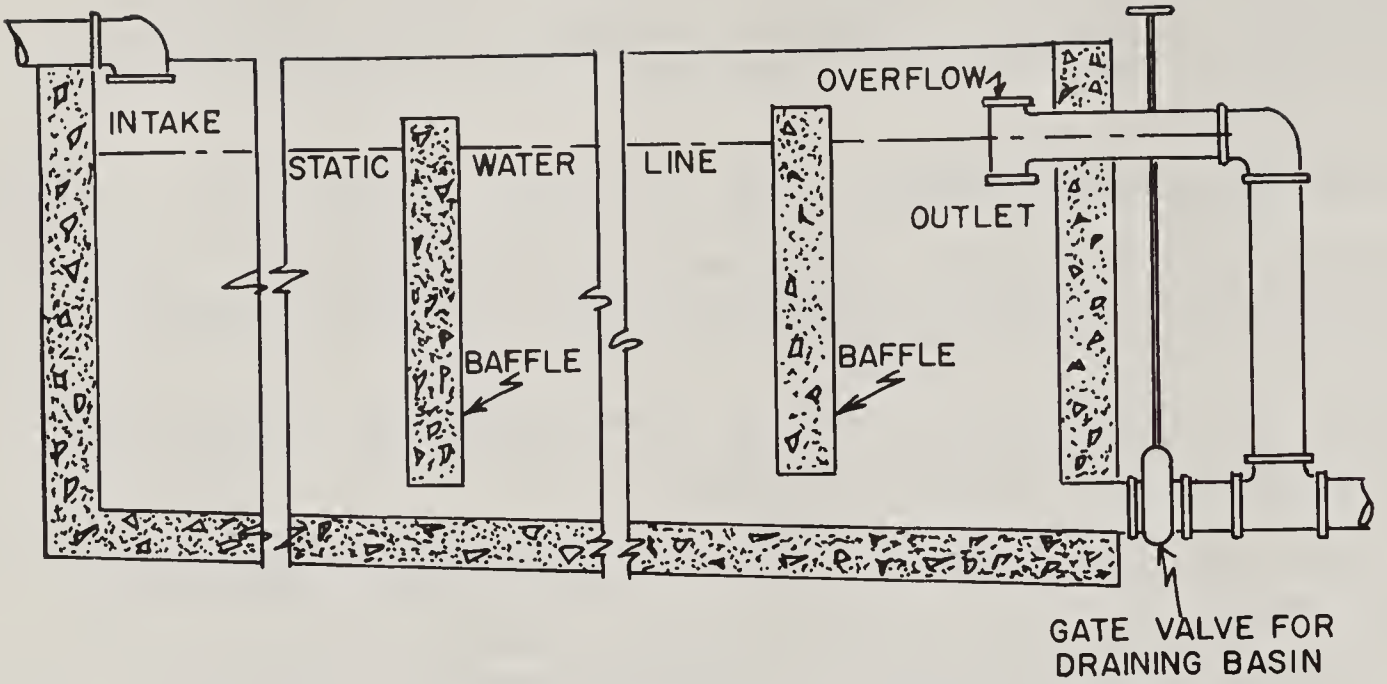
Suitable facilities, such as a blow tank or water-tight containers, must be provided for the transfer of grease to the point of disposal after it is skimmed from the basins. Settlings are to be handled in a similar manner.

Catch basins must be suitably located and not placed in or near edible products departments or areas where edible products are unloaded from or loaded onto vehicles. The area surrounding an outside catch basin shall be paved with impervious material such as concrete, and provided with suitable drainage facilities.

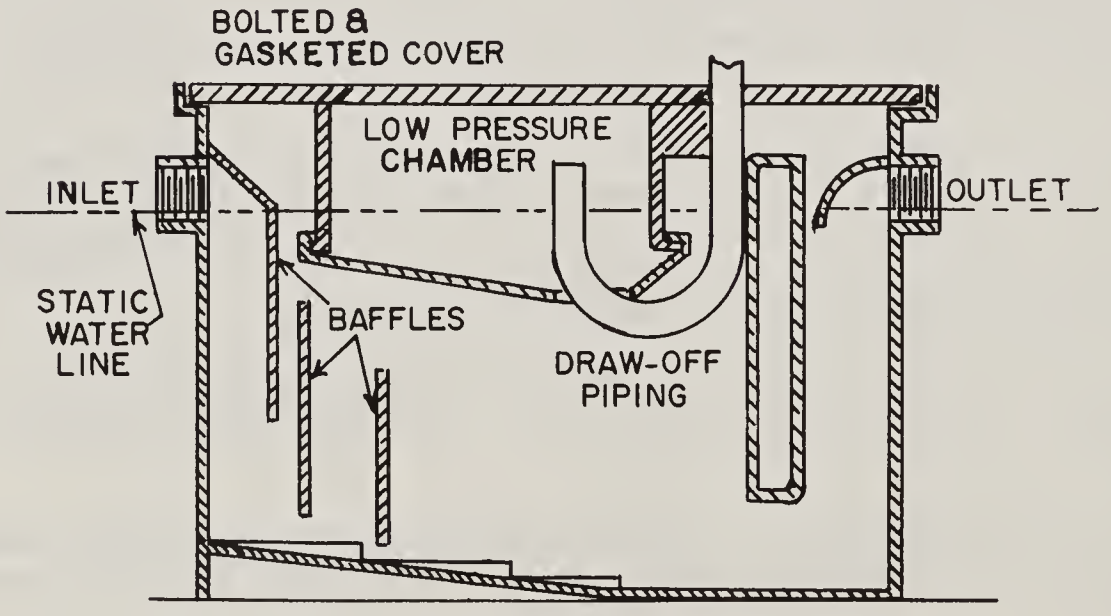
To facilitate ready cleaning, basins must have inclined bottoms and should be without covers. They are to be constructed so that they can be completely emptied of their contents for thorough cleaning each day following the plant operation. Hose connections for furnishing hot water for clean-up purposes should be provided at convenient locations near the basins.

Grease traps are similar to catch basins in that they allow grease to separate from the drainage. These traps are considerably smaller and are not used in large operations as a means of fat salvage.

Grease traps may be installed only on plant drainage lines and must be cleaned regularly if they are to be of any value. The use of grease traps must not cause a nuisance.



CATCH BASIN



GREASE TRAP

Disposal of Paunch Contents, Hog Hair, Blood, and Similar Waste Material

Waste materials such as paunch contents, hog hair, blood, and pen manure must not be allowed to accumulate on or near the premises and must be disposed of without creating objectionable conditions.

Manure which has been removed from livestock pens frequently becomes a problem. Immediate removal from the premises is the best procedure, but under some circumstances, temporary storage of manure is necessary.

Properly drained concrete storage bins are necessary as storage of manure on the ground surface is unacceptable. Even when adequate temporary storage facilities are provided, at least a once-weekly removal schedule should be established and the bins thoroughly cleaned before reuse.

Blood that is not processed within the plant must be removed daily in water-tight covered containers. Filling of blood containers is to be done in a well drained, paved area equipped with water outlets. The area is to be washed at least daily and at more frequent intervals if needed.

Hog hair, paunch contents and the like are to be removed daily.

Rubbish Removal

Rubbish such as used paper towels, cartons, office waste, labeling materials, etc., frequently can be a sanitation problem. Suitable containers conveniently located throughout the plant must be provided and emptied frequently.

The accumulation of rubbish prior to its removal or incineration must not cause a nuisance. (Refer to section on Outside Premises for a more detailed discussion.)

CHAPTER XVI

EQUIPMENT

Equipment used in meat handling and processing ranges all the way from the most simple hand tools to large, highly complex, electronically operated machinery. Since there is extensive contact of product with equipment surfaces, this is where potential hazards to product safety and cleanliness lie.

Therefore, equipment must be constructed and maintained so that it can be easily kept clean. All surfaces contacting product must be free of scale; should be smooth, nonporous; and should be free from pits, crevices, seams, or joints in which food may lodge, decompose and support the growth of organisms.

The overall design and installation of equipment should provide for easy cleaning and sterilization where necessary. It must also conform to applicable specifications in Agriculture Handbook No. 191, "U. S. Inspected Meat Packing Plants: A Guide to Construction, Equipment, Layout."

Materials used within the product zone must be nonabsorbent, nontoxic, odorless and must be unaffected by food products and cleaning compounds.

Acceptable Materials

A. Metal

With few exceptions, equipment must be constructed either of rust-resisting metal, such as 18-8 (300 series) stainless steel, or of plastic approved by the C&MS Technical Services Division. Galvanized metal, although acceptable in certain equipment, is not desirable because it is not adequately resistant to the corrosive action of food products and cleaning compounds. When used, galvanized metal must have the smoothness of high quality commercial hot dip.

*-Copper has some limited uses in connection with food processing equipment such as in water lines, air lines, and gear bushings and seals outside the product zone. Because of its catalytic action, copper and its alloys are not acceptable for use in pumps, fittings, lines or other equipment used to handle edible fats and oils.

Alloys containing copper find some application in food processing equipment, provided they do not stain or otherwise affect the product or contribute to unsanitary conditions. Proposals for use of copper or copper alloys in applications other than listed in the preceding paragraph should be presented to the Equipment Group for approval.-*

B. Plastics and Resins

Plastic materials and resinous coatings must be abrasion - and heat-resistant, shatterproof, nontoxic, and shall not contain a constituent that will migrate to meat or other products in contact with the material. Metal drums coated on the inner surface with lacquer or resin may be used for rendered fats, providing the coating is smooth, odorless, hard and does not peel or blister.

All such materials and coatings must be approved by the Technical Services Division prior to use. Such approval is usually given only to the manufacturer, and then only after submission of a statement showing the chemical composition, intended use, method of applications, action while in contact with water, and product, and any toxicological data deemed necessary.

Nonacceptable Materials

There are many materials that are highly undesirable or totally unacceptable for use in equipment construction. The following is a partial listing. Questions on other materials should be directed to the Technical Services Division.

* * *

A. Cadmium and antimony are toxic compounds and are not acceptable in any manner or form in equipment used for handling edible product.

B. Also, due to its toxic nature, lead must not be used in equipment contacting edible product, except that it may be employed in dairy solder in an amount not to exceed 5 percent. Lead babbitt, frequently employed in head splitting equipment, is not acceptable. Nylon or other approved plastics make suitable substitutes.

C. Due to the high risk of chipping, the use of containers or equipment made of enamelware or porcelain is not acceptable for any purpose in connection with the handling and processing of product.

D. Painted surfaces are not permanent and may readily contaminate the food. Therefore, paint is not acceptable on any equipment area which may contact product.

E. Wood is not a satisfactory material for equipment construction since it does not maintain a smooth surface and is not impervious. Wood used in any manner resulting in product contact is strongly discouraged. It is permitted only in those situations where strict sanitary standards are practical and can be rigidly enforced.

F. Leather and fabrics, due to their porous nature, are not acceptable materials for equipment construction. Filter cloths used in rendered fat filter presses are permitted, provided they are clean and freshly laundered.

G. Dissimilar metals should not be used in equipment construction if their contact with liquid or other products may create harmful chemical and electrolytic action.

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CHAPTER XVII

EQUIPMENT DESIGN AND CONSTRUCTION

Sanitary design principles apply to all types of equipment used in the slaughter of livestock and the handling and processing of product. The primary objective of sanitary design is to facilitate keeping equipment clean, thereby controlling and preferably eliminating product contamination. The continuing push for greater and greater production generally tends to increase the contamination hazards and sometimes seriously curtails the time available for clean-up. Sound sanitary design of both the plant and equipment then becomes even more essential.

In order to encourage the thorough cleaning of equipment, the time and the ease of disassembly are important considerations. Equipment should be as simple in construction as possible and contain the fewest number of parts practical to permit easy dismantling and reassembly following cleaning. The design, construction, and installation should be such that permits easy access for sanitary, as well as mechanical, maintenance.

In-Product Zone

A. Accessibility for Cleaning

All parts of the product zone must be readily accessible to sight and reach for cleaning and inspection. In large equipment, appropriately located clean-out and inspection openings, catwalks, ladders or other suitable provisions must be made to insure that all parts can be cleaned and inspected. It is the plant management's responsibility to demonstrate compliance with this requirement.

B. Clean-In-Place (CIP) Systems

CIP systems are those which do not require complete dismantling for cleaning. Such equipment must be especially designed for CIP procedures that will result in the same or greater degree of cleaning effectiveness as that obtained by dismantled cleaning. Cleaning procedures of this type are only permitted under special conditions individually authorized by the Technical Services Division.

The general criteria used for accepting CIP systems are:

1. Arranged so cleaning and sanitizing solutions can be circulated throughout the fixed system.

2. Such solutions will contact all interior surfaces.

3. The system is self-draining or otherwise completely evacuated.

4. The cleaning procedures result in thorough cleaning of the equipment.

*- 5. Interior finish of pipe should be smooth enough to enable inspector to determine if pipe is clean. Interior of pipe should have highly polished finish (120-180 grit).

6. Provide inspection openings at all changes in direction by the use of easily removable elbows.-*

It is important to note that any pipeline, valve, fitting or part not included and cleaned by the CIP system should be disassembled and manually cleaned. In situations where CIP systems are in use, it is the plant management's responsibility to make the detailed cleaning procedure and its Technical Services Division's approval available to the inspector.

C. Gaskets and Packings

All gasketing and packing materials must be nontoxic, nonporous, nonabsorbent, and unaffected by food products and cleaning compounds. Such materials should be installed in a true fit to prevent protrusion of the materials into the product zone or the creation of recesses or ledges at the gasketed joints.

D. Seals and Bearings

All bearings must be located outside the product zone. If it is adjacent to it, it must be constructed with a seal at the entrance of the shaft into the product zone. Sufficient space must be provided to permit the easy removal of the seal assembly for easy cleaning and inspection. Seals and bearings must be installed and maintained so as to prevent lubricant leakage or entrance of product into the assembly.

E. Interior Corners

Interior corners of equipment must be provided with radii (1/4-inch minimum), except where greater radii are required for easy drainage and cleaning.

F. Welded Joints

All welding within the product zone must be continuous, smooth, even, and relatively flush with the adjacent surfaces.

G. Freedom from Cracks, Recesses, Ledges, and the like

All parts of the product zone must be free of recesses, open seams and gaps, crevices, protruding ledges, inside threads, inside shoulders, inside bolts or rivets, and dead ends.

H. Self-Draining Equipment

Where necessary for sanitary maintenance, equipment must be constructed and installed so as to be completely self-draining.

I. Screening, Straining and Filtering Surfaces

All screening, straining and filtering surfaces shall be readily removable for cleaning and inspection. Screening and straining devices should be designed to prevent replacement in an improper position. Permanent screening and straining surfaces should be fabricated from perforated metal.

On dry granular or dry pulverized product, wire screen of not less than 30 x 30 continuous mesh may be used.

Filter papers must be of the single-service type. Filter cloths or spun glass filters shall be launderable.

J. Pumps, Pipelines, and Valves

Pumps, pipes, conductors, valves and fittings used in connection with edible product (including edible brine or vinegar solutions) should be constructed of 18-8 type stainless steel or approved plastic. High-impact resistant glass pipelines may be approved on an individual basis by Technical Services Division.

Pumps and pipelines conveying edible product must be easy to separate for cleaning. They must be kept clean and sanitary and be constructed so that there are no dead spaces in which product may stagnate.

-This requirement also applies to lines used to convey raw fats. Black iron pipelines with threaded or welded joints have been permitted on lines for conveying rendered fats.-

K. Conveyor Belts

All belts used to convey exposed product must be of sanitary grade, moisture-resistant, nonabsorbent material with no exposed fabric core. Conveyor guides, splash guards, etc., should be easily removed or of open construction to permit cleaning.

L. Lubricants

Equipment in which lubricating grease or oil is used should be designed to prevent the contamination of product by lubricating material. As a further precaution against the inclusion of toxic compounds in product, all lubricants used in areas where potential contamination exists must be edible and specifically approved by Technical Services Division.

If the possibility of contamination of products by lubricants exists, the establishment should be required to take suitable corrective measures without delay. A particular concern is the contamination potential of lubricants used in overhead motors, gears, and similar devices. If drip pans are necessary to provide protection, they should be easily accessible for inspection and removable for cleaning.

In-Product Zone

Parts of equipment outside the immediate product zone are also important due to the hazards of indirect and/or accidental contamination of product. In many cases, workers handle product and equipment alternately which increases the contamination potential.

Therefore, many of the principles of design and construction illustrated in the product zone apply here as well:

A. All external surfaces must be free of open seams, gaps, crevices, and inaccessible recesses.

B. Horizontal ledges or frame members must be kept to a minimum.

C. All external parts should be of round or tubular material where possible to avoid accumulation of debris and to permit easy cleaning.

D. All safety or gear guards must be readily removable for cleaning and inspection.

E. Components that may not be cleaned (motors, electrical gear, etc.) must be sealed against entrance of product and water.

CHAPTER XVIII

EQUIPMENT INSTALLATION

Certain requirements on the placement, arrangement and installation of equipment have been established to permit convenient, positive cleaning. Constant attention must be given to these details in order to maintain an orderly flow and clean handling of product. The initial installation of equipment and every change in operations must be carefully analyzed for potential sanitation problems. Any circumstance that could result in product contamination should be avoided.

Spacing from Walls, Ceiling and Floor

All permanently mounted or not readily movable equipment must either be installed sufficiently above the floor and away from wall and ceiling areas to provide access for cleaning and inspection or be completely sealed (watertight) to these areas.

Whenever equipment, chutes, or pipelines pass through walls, they should either be sealed to them or sufficient clearance should be allowed to permit inspection, cleaning and maintenance. Where pipes pass through ceilings of exposed product areas, pipe sleeves should be inserted in the floor above so that their upper periphery is at least 2 inches above the floor.

Wall-Mounted Facilities

Wall-mounted cabinets and electrical connections (such as switch boxes, electrical panels, and BX cables) must be either installed at least 1 inch from equipment or walls, or be completely sealed (watertight) to the equipment or walls.

Water Connections and Control of Waste Water

Where possible, water inlets must discharge above the highest level reached by liquids in the equipment. Those installations requiring submerged water lines must be equipped with a functional vacuum breaker (described elsewhere in this handbook).

Drains should be of adequate size to permit rapid draining without spillage and should be at the lowest point with no inside collar or projection.

All equipment handling waste water must be installed so the waste water is delivered into the drainage system without flowing over the floor.

Equipment handling edible products such as sausage tables, soaking and cooking vats, can sterilizers, tripe scalders and casing preparation equipment should be installed so that waste water from each unit is delivered through an interrupted connection into the drainage system. For some equipment such as tripe scalders, this can be accomplished by placing the machine in a curbed area (6 inch minimum).

Without this break in drainage, the equipment actually becomes a part of the plant waste system and any sewage back-up would result in dangerous contamination of product. That part of the equipment drainage system from the equipment to the interrupted connection is considered as potentially contacting product. Therefore, it must be constructed, maintained, and cleaned to the same standards expected for surfaces with direct product contact.

Valves on drainage lines serving such equipment should be a type easily cleaned and must be mounted flush with the bottom of equipment.

Soaking and cooking vats should be provided with overflow pipes at least 2 inches in diameter. The upper end of each overflow pipe should be equipped with an open-end clean-out for easy cleanings.

Vent Stacks from Hoods

Vent stacks from covered cooking vats or hoods over cook tanks should be arranged or constructed so as to preclude drainage of condensate back into the vats.

Water on Work Tables

All tables or other equipment having water on the working surface should be provided with turned-up edges. The height of the turned-up edge depends on the volume of water used and the operations conducted. In no instance should the turnup be less than 1 inch.

Magnetic Traps and Metal Detectors

Due to the extensive exposure of some products to metal equipment such as grinders, choppers, mixers, shovels, etc., there is a possibility of contamination with metal particles. Magnetic traps have been found effective in removing iron particles from chopped or semi-liquid products.

However, these magnetic traps are of no value in removing nonmagnetic metals such as stainless steel or aluminum. Therefore, the use of electronic metal detectors is highly recommended in such locations as sausage emulsion lines, can filling lines (particularly those for baby food), etc.

Metal detectors are usually installed so an alarm (either a bell or light or both) is activated when a metal fragment is in the detection zone. It is desirable for the production line to stop automatically when the detector is activated. Some systems are arranged so the portion of the product containing the metal contaminant is automatically removed from the production line.

The use of such traps and detection devices should not be a replacement for sound maintenance and inspection programs designed to prevent metal contamination of product.

Air Lines

In certain plant operations, air is used in such a manner that it may intentionally or accidentally contact or become incorporated into product. Examples include: operation of various air-driven knives and clippers; mixing air with water in some carcass washing operations; inflation of lungs for Kosher examination; turning and grading casings; inflation of bladders, beef bungs and similar casings to inspect for defects; pickle agitation; removal of loaves from pan molds; drive stuffer pistons; can cleaning; to keep certain equipment areas free of debris during operations; in lard, shortening and oleo manufacturing; etc.

It is important that air be clean and free from moisture and oil from the compressor. Therefore, an effective filter should be installed in the air intake so that only filtered air enters the compressor.

The compressed air storage tank should be equipped with a drain so accumulated oil and moisture can be drained away frequently. Water and oil traps with petcocks should also be installed and utilized in the air lines between the storage tank and the use outlet. Spent air must be exhausted in such a manner that prevents product contamination.

Equipment which introduces air into product, uses air to convey product or otherwise allows pressured air to come in direct contact with product must be fitted with a filter located as near the use outlet as feasible. This filter should be capable of withholding particles 50 microns or larger in size and should be readily removable for cartridge replacement or cleaning.

In the case of votators, air or nitrogen is introduced and incorporated into the product by means of a partial vacuum existing in the system as a result of rapid product chilling. The same filter requirements apply on these intake lines.

Equipment Washroom

A separate washroom or area should be provided in a location convenient to the department involved for cleaning curing vats, handtrucks, utensils, and containers such as pans and trays. The room or area must have adequate light and ventilation, impervious well-drained floor, impervious walls and ceiling, and an exhaust fan for dispelling steam vapors.

In plants using cages or trees for smoking sausage or other product, facilities for washing and rinsing such equipment are required.

CHAPTER XIX

REQUIREMENTS FOR EQUIPMENT IN GENERAL USE

Lavatories

-Conveniently located hand-washing facilities (lavatories) with a bowl size of about 12 by 16 by 6 inches should be provided for the employees and inspectors. Each lavatory must be supplied with:-

A. Hot and cold running water delivered through a combination mixing faucet with outlet about 12 inches above the rim of the bowl to facilitate washing arms as well as hands.

B. Liquid soap and an ample supply of sanitary towels in suitable dispensers.

C. A suitable receptacle for used towels.

Lavatories in workrooms and welfare rooms should be pedal operated.

Lavatories should also be directly connected to the drainage system.

Drinking Fountains

Sanitary drinking fountains should be provided in large workrooms and in dressing rooms. If desired, they may be located at lavatories and arranged so the overflows discharge into the bowls of the lavatories. If this is done, they should be placed sufficiently high above the bowls to avoid splash onto them when the lavatories are used.

Drinking fountains are particularly important in meat processing departments, otherwise employees may drink from any available cold water outlet. This could result in contaminating product and/or equipment surfaces with water from the employee's mouth and face.

Tables, Sinks, and Sprays for Reconditioning Product

Occasionally product may become unclean by accidental contamination. If practical, it may be cleaned with water. Then the product must be individually washed immediately following accidental contamination and must not be allowed to accumulate.

Separate equipment must be provided for this purpose. A removable perforated metal rack to hold product off the bottom of the sink must be provided. Reconditioning sinks should be identified and other efforts made to preclude their use for hand washing or implement cleaning. In areas such as boning rooms, these sinks should be conveniently located to insure proper usage.

Sterilizers

Sterilizers should be constructed of rust-resistant metal (preferably stainless steel), and should be of sufficient size for complete immersion of knives, cleavers, saws, and other implements in hot water (minimum temperature 180°F). They should adjoin the lavatories in slaughtering departments and elsewhere as required.

Each sterilizing receptacle must be provided with a water line (equipped with a vacuum breaker if submerged), a steam line or other means of heating, an overflow, and facilities for completely emptying the receptacle.

Sterilizers, particularly those used in heavily contaminated areas, must continually overflow during operations.

Hose Connections

Adequate and conveniently located hose connections for clean-up purposes shall be provided throughout the plant. The use of long hoses should be avoided. Suitable racks or reels must be provided for storing the hose when not in use.

Chutes

Many types of chutes are used to convey product from one department, floor, or level to another. They should be constructed so thorough cleaning is possible and ready access for inspection is provided.

Edible product chutes - if feasible the rounded, trough-type chute is most desirable. Chutes should be made demountable so they can be taken down in segments of convenient size for cleaning. Where chutes go through floors, the opening must be surrounded by a concrete curb or a metal flange extending 12 inches or more above the floor. This is to prevent floor drainage from entering the chute. The portion of chute fitting in the floor flange should be removable for cleaning. Closed chutes must be sectionalized to permit cleaning and inspection of all parts and surfaces.

Chutes connecting edible and inedible products departments must be hooded at the edible end and vented to the outside. This, along with a self-closing trap door at the entrance to the hood, prevents passage of odors to the edible products department.

Chutes used to convey inedible or condemned products through edible products areas must be constructed and installed so as to prevent any leakage and possible contamination of the edible product or department. Clean-out and inspection openings must be equipped for official seals.

Cutting and Boning Boards

Boards used on boning and cutting tables should be constructed of approved plastics and must be chamfered on all edges to prevent undue chipping. Solid (unlaminated) pieces of hardwood are acceptable only if they are

maintained in a smooth, sound condition, are free from cracks and are thoroughly cleaned, sanitized and air dried after each day's operation.

Boards must be easily removable for cleaning and shall be in the shortest section practical (preferably not exceeding 3 or 4 feet in length).

In-Plant Trucks

Trucks used to transport product within the plant should preferably be constructed of stainless steel. When galvanized metal trucks are used, they must be kept in good condition and regalvanized whenever necessary.

Trucks should be free of cracks and rough seams. Metal wheels should be avoided as they cause deterioration of the floor surfaces.

All trucks should have some means of affixing a tag. This can be easily accomplished by drilling two holes approximately 1 inch apart in the lip of the truck to accommodate string or wire.

Trucks are to be cleaned daily. Those not empty at clean-up time are not to be reused until they are cleaned. Trucks should be cleaned on all surfaces including the under side.

In plants utilizing large numbers of trucks, it is advisable to have a separate area specifically designated and equipped for truck cleaning.

Since it is essential that positive identification is maintained of inedible and/or condemned products, trucks used for inedible and/or condemned products cannot be used for edible products.

CHAPTER XX

DRY STORAGE AREAS

Because there is a wide variety of supplies used in connection with meat production and packaging, such as dry product ingredients, packaging materials, and cleaning and maintenance items, good housekeeping and cleanliness in storerooms are essential to any sound sanitation program.

To facilitate cleaning and to avoid harboring places for insects, rodents and vermin, provisions must be made to store supplies on racks at least 12 inches above the floor and passage ways maintained between rows of racks. Racks should be sufficiently spaced away from walls so the entire floor-wall junction is visible for detecting evidence of insect or rodent infestation. All openings that may admit rodents, birds, flies, and other pests should be effectively screened.

There should be a systematic turnover of supplies to avoid the accumulation of old and useless material. As they are emptied, storage racks should be taken up, cleaned, and the floor area cleaned prior to replacing the racks for further storage.

Storage space should be conveniently located near departments where supplies are used, particularly in operations such as bacon slicing, prepackage luncheon meat, etc., that require a large volume of packaging and labeling material.

Spice rooms are specialized storage areas and their use is to be limited to storage and blending of spices, condiments and curing agents. These rooms must be maintained scrupulously clean. Ingredients should be stored in closed metal containers placed on racks at least 12 inches above the floor. Utensils, scales, scoops, and other equipment used for weighing and mixing spices, condiments and/or curing agents, should be approved metal or plastic of a kind that can be kept in a clean condition.

CHAPTER XXI

INSECT AND RODENT CONTROL

Insects and rodents are capable of transmitting a number of diseases to man through contamination of food. So, their presence in a meat plant creates a potential public health hazard. The only way to guard against this is by effective vermin control.

Prevention

Elimination and destruction of insects and rodents in and around meat packing plants are vital to good sanitation. Two principles should be followed: prevent their breeding; and prevent their entrance into establishments.

In nearly all cases the owners of adjoining properties and the local health authorities will cooperate in developing a program for insect and rodent control. The management should obtain such cooperation.

Any place that will afford food, water, and a hiding place is a potential source of pests. The most common places are manure piles, trash piles, garbage dumps, accumulations of paunch and stomach contents, and hog hair. USDA regulations do not permit such accumulations on the premises of official establishments.

The cooperation of the local health authorities should be solicited by the management in eliminating such breeding places from the vicinity of meat packing plants.

Buildings and equipment that harbor pests should be repaired or replaced so as to eliminate breeding and hiding places. Walls, floors, and ceilings that have been tunneled by rodents should be replaced with rodent-proof material, such as concrete or brick. Tunnels may be blocked with 17 gauge hardware cloth, glass, metal, or other rodent-proof material.

Stone and brick walls should have the joints pointed up flush and smooth, and all cracks, crevices, and openings around pipes, etc., should be sealed tight. Walls, ceilings, and partitions should be of tight-fitting material that will not permit the entrance or hiding of cockroaches and other pests.

Floor drain strainers should be in good repair and should remain in place so as to prevent the entrance of rats through drainage lines.

Dressing rooms and lunch rooms should be equipped and maintained so as to eliminate all breeding or hiding places.

Lockers should be examined regularly by the management and inspectors to see that they are kept clean and free from pests. Overcrowding (more than one person to a locker) should not be permitted, since it is difficult to keep overcrowded lockers clean and free from cockroaches.

Dry storage rooms should be kept neat and clean. The stored material should be arranged so that as the supplies are moved the area can be thoroughly cleaned. Most dry stores can be placed on racks having a clearance of at least 12 inches from the floor and so arranged that the floor beneath the racks can be readily cleaned. If racks are not used, the dry stores should be closely piled so as to eliminate any possibility of runways or harborage for rodents. All openings that may admit rodents, birds, flies, and other pests should be effectively screened.

When pests do gain entrance to official establishments in spite of rigorous attempts to keep them out, certain eradication methods are permitted. This is an indication that the preventive measures have not been entirely successful and the management and inspectors should determine where they have failed and act to prevent a recurrence.

It takes ingenuity to cope with all of the various kinds of insects and rodents. The goal of complete eradication of pests in official establishments is definitely possible and this goal should be attained.

Control

Following is a description of permitted methods for the control of insects and rodents by the use of chemicals:

Fumigants

A. Hydrocyanic Acid Gas. Fumigation with this gas is effective for most types of insects and rodents. Since this gas is extremely poisonous to man as well as to insects and rodents, permission for its use must first be obtained from the Officer in Charge and a competent, experienced person must be placed in direct charge of operations.

Certain foods absorb the gas; therefore, when foods other than meat are to be exposed, prior permission for the fumigation should be obtained from the local health authorities. Exposed meats or packaged meats need not be removed from the rooms being fumigated.

After fumigation the rooms should be well ventilated and tested by a skilled fumigator before inspectors or workmen enter the rooms. Ventilation must also be sufficient to assure complete removal of the gas from the surface of food products.

Hydrocyanic acid gas may also be employed to eradicate mites, skippers, ham beetles, and the like from infested hams and similar products. Follow this by removal and condemnation of infested meat.

When liquid hydrocyanic acid is used, the equipment for releasing the gas should be constructed and controlled so as to positively prevent any of the liquid hydrocyanic acid from contaminating any product. Only the gas should be permitted to escape from the fumigating equipment.

B. Methyl Bromide Gas. Fumigation with this gas is permitted on the same basis and with the same restrictions as for hydrocyanic acid gas.

Insect Sprays

A. Warning! Sprays containing some of the organic thiocyanates are quite toxic to animals and man, and when absorbed through the skin, ingested, or inhaled may cause serious illness. For this reason, it is considered wise for employees engaged in this work to wear properly designed masks to prevent inhaling the spray and clothing that will prevent contact of the chemical with the skin.

B. The residual action of DDT, chlordane, lindane, malathion, and more concentrated solutions of some other insecticides is usually effective against flies. The use of these solutions around the outer premises and inedible products departments has been satisfactory.

A liberal application of these preparations on fences, the walls of the scale houses, inedible products loading docks, boiler rooms and the like, affords opportunity for flies attracted to the establishment to come in contact with the insecticide material and be killed before they can enter edible products departments.

By contrast with this satisfactory use of insecticides, their application to walls, ceilings, and equipment in rooms where exposed meat or product is handled should not be permitted. The deposit of insecticide cannot be readily removed and continues to act rather slowly against flies or other insects which when overcome or killed may fall into the product.

As the action of the insecticide is continuous, there is no practical way to protect the exposed product from contamination with dead insects. Therefore, the use of these insecticides is limited to places where exposed meat is not handled.

C. So-called "knockdown" sprays containing pyrethrum or allethrin do not have a residual killing action and may be used in places where exposed meat is to be handled according to the restrictions outlined above.

As these insecticides act very quickly, it is possible to kill all the flies in the room and with a minimum of labor wash down the excess insecticide and any flies that have been killed before any exposed meat is brought into the room.

This use of the "knockdown" sprays, in addition to the application of residual insecticides as already outlined, should control flies on premises that are kept clean and free of fly-breeding places.

D. The following mixture is a very satisfactory bait material around livestock pens and inedible departments of official establishments: one and one-half fluid ounces of emulsifiable 50 percent strength malathion added to five pounds of granulated sugar and thoroughly mixed with a

small amount of coloring (blue or green) to give a distinctive color to the mixture. Care should be taken to place the bait so that it cannot be ingested by livestock.

E. Colored sugar baits (blue or green) containing one to two percent of either Diazinon or Dipterex have also been used effectively for fly control in these areas.

F. Deodorized kerosene solutions of pyrethrins or allethrins or a combination of the two, containing not more than one percent of piperonyl butoxide, may be used in the form of an aerosol in all departments, but this must be in accordance with the restrictions applicable to pyrethrum extracts.

G. Solutions containing more than one percent of piperonyl butoxide, N-propyl isome, and N-octyl dicycloheptane dicarboximide (MGK 264) and solutions of chlordane, lindane, methoxychlor, and malathion with or without other approved insecticides may be used with the limitation applicable to DDT--that is, outside edible products departments.

H. Allethrin is acceptable on the same basis as pyrethrin--that is, in deodorized kerosene solution or other approved carrier.

I. N-propyl isome is acceptable on the same basis as piperonyl butoxide.

J. N-octyl dicycloheptane dicarboximide (MGK 264) is acceptable on the same basis as piperonyl butoxide.

K. Insect repellents containing di-n-butyl succinate as the active ingredient are effective around loading docks, door and window facings, and similar areas of official establishments.

Insect Powders

A. Any of the dry insecticidal compounds listed, when mixed with dry inert material, are acceptable for use as an insect powder in accordance with the restrictions applicable to the same insecticide used in insect sprays.

B. Sodium fluoride, powdered pyrethrum, rotenone, borax and boric acid, and powders containing organic thiocyanates or DDT in an inert base may be used for the elimination of cockroaches under the same restrictions governing the use of sprays.

With the exception of powders that possess a definite brown color, all powders should be definitely colored blue or green.

Rodent Baits

A. Anticoagulants. Anticoagulants produce internal hemorrhages in rodents and other warm-blooded animals and must be eaten over a period of 2 to 10 days to produce a lethal effect. The physiological action of these chemicals is similar to that of the dicumarol widely used in medicine as

an anticoagulant for blood. It must be remembered that bait boxes within the building of an establishment are a means of eliminating rodents as opposed to controlling rodents. Control should be accomplished by rodent proofing buildings and maintaining a rodent-free zone around buildings.

Rodent baits composed of Warfarin, Pival, Fumarin, Diphacin, PMP, or Prolin and cracked cereal grains or blue or green colored cereal of other vegetable meals or flours may be used in edible departments provided the layout has been approved by the Officer in Charge. The bait should be contained in boxes plainly marked "RODENT BAIT."

For proper adherence, cracked cereal grains should be thoroughly mixed with enough melted animal or vegetable oil to lightly coat each particle before the addition of the anticoagulant. This requires approximately two ounces of oil to five pounds of grain.

Each bait box should be marked with a serial number and the name of the firm or individual responsible for the rodent control. Bait boxes should be constructed so that all sides, top and bottom, are capable of being closed and fastened leaving only openings for the free entrance and exit of rodents.

Aqueous solutions of anticoagulants may be used in drinking fountains similar to those used in the poultry industry, but the solution should be colored green and the fountain marked and used in bait boxes of the same type and markings as described above.

Bait boxes and bait boxes containing fountains for dispensing dry and liquid anticoagulants may be allowed to remain continuously in departments having a dry cleanup so long as the need exists and the box does not become a nuisance. Bait boxes placed in areas having a wet cleanup must be placed after the cleanup and removed to an acceptable dry area prior to the beginning of operations.

B. Red Squill. This substance mixed with proper bait is highly toxic to rats. Baits should not be placed in edible products departments until after operations have ended for the day. All uneaten baits must be gathered up and destroyed before operations are begun the next day.

Baits must not be placed in dry salt cellars. They may be placed in other departments containing exposed meats, but care must be taken so they are placed to prevent contamination of the meat.

C. Tracking Powders and Sticky Boards. Tracking powders colored blue or green and sticky boards may be used in departments having a dry cleanup, provided there is no exposed product in the department.

Sticky boards may also be used in departments having a wet cleanup, provided there is no exposed product and the sticky boards are placed after the cleanup and removed prior to beginning of operations. Neither tracking powder nor sticky boards should be used in a manner to create a nuisance.

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D. Storage and Use of Insecticides and Rodenticides. When insecticides and rodenticides are stored in official establishments, they should be in a location acceptable to the Officer in Charge and should also be under the supervision of a responsible establishment employee.

When used by an establishment employee, the use, preparation, and placing of baits must be under the direct supervision of a Program inspector. Otherwise, these materials should be used only by pest control operators licensed by the state in which they operate.

No condition that may be a source of danger to human health or that is not consistent with proper sanitation or inspection should be permitted to develop.

CHAPTER XXII

SANITARY DRESSING PROCEDURES, IN GENERAL

Sanitary handling of meat begins with the slaughter and dressing operations. Effective control over sanitary dressing procedures, is vital to the production of a clean, wholesome and safe product.

The attitude and ability of plant employees, the class and condition of livestock slaughtered, and the design and construction of plant and equipment all contribute to the relative difficulty in obtaining clean carcasses.

Sanitation of farms and feed lots and adverse weather conditions also are significant in the implementation of sanitary dressing procedures.

Construction, drainage and sanitation of the plant livestock holding facilities are extremely important, since livestock moves through them to slaughter.

The internal tissues of a normal, healthy, living animal are virtually sterile. The live animal has two main exposures to the outside environment:
A. One is its protective covering of skin or hide which in turn is covered with hair, manure, dirt, etc., in itself a source of objectionable contamination. But of even more significance, these potential contaminates contain a wide variety and exceedingly large number of microorganisms;

B. The other main exposure is that of the gastrointestinal tract which is in reality a long tube extending from the mouth to the anus into which food is consumed, digested, and from which wastes are excreted. Not only are microorganisms injested with the feed and water, but their propogation and growth are very significant parts of the digestive process, so much so that much of the fecal mass is actually a concentration of microorganisms in astronomically large numbers. The respiratory system and reproductive and urinary tracts may be exposed to the outside environment and are potential sources of meat contamination.

It is the principal objective of sanitary dressing procedures to remove or clean the hide or skin and to remove the gastrointestinal tract and other internal organs with minimum contamination of the meat. The process is difficult enough in healthy animals. It is more complicated in animals with localized or generalized diseases, many of which are not detected until the dressing operation has been partially or entirely completed. Since inspectional procedures are designed to detect and remove these abnormal conditions and since it is not known with certainty prior to inspection all the animals which are affected, sanitary dressing procedures must be designed to eliminate common contact of skinned carcasses and parts prior to inspection. This is also the basis for requiring cleaning and sterilization of certain instruments and equipment between each use (i.e., dehorning equipment, knives used to sever hog heads, brisket knives or saws, moving top viscera tables, etc.).

The diseased animal may also pose a serious contamination threat and public health hazard via other tissues and fluids, such as bile, urine, milk and fluids and tissues from the reproductive tract. These are considered as objectionable types of contamination in all animals.

All diseased tissue and associated fluids (such as pus) must not be allowed to unnecessarily contaminate product, workers, equipment or environment. When such contamination does occur by accidental or other means, strict, careful correction must be immediately accomplished. This again emphasizes the necessity of plant and equipment being designed, constructed and arranged so that they are easy to clean.

The slaughtering and viscera separation departments, in addition to handling a large volume and variety of clean and unclean materials, are supplied with abundant moisture and warm temperatures. This is ideal for rapid growth of microorganisms; therefore, strict sanitation and orderly handling of product to insure rapid chilling are essential.

The "final" veterinary inspector is the immediate supervisor of the slaughtering and related departments to which he is assigned. He is responsible for all matters pertaining to inspection. This applies not only to the actual final inspection of retained carcasses, but also to the sanitary condition of the premises, sanitary dressing procedures, the condition and operation of equipment and the work of C&MS employees who may be under his supervision.

Inspectors assigned to post-mortem duties are responsible for seeing that sanitary dressing procedures are followed. They should observe the condition of rooms, equipment, and clothing of plant employees to see that they are clean and that the equipment, including sterilizers, wash basins, and facilities for inspection, are in proper working order.

Each inspector should constantly observe the maintenance and use of sterilizers and wash basins during operations and require that they be properly maintained and used.

The following are general guidelines of sanitary dressing applicable to all species of livestock slaughtered:

A. The first and paramount rule of sanitary dressing is to avoid any contamination of edible portions of the carcass with materials such as feces, urine, hair, ingesta, milk, bile, pathological tissues and exudates, and other filth. All controls of slaughter and dressing procedures must be aimed at accomplishing this purpose. It is essential that this basic rule is observed as the <u>first</u> guideline for control.

Many problems will be avoided if slaughter operations are conducted in a manner that precludes contamination. This includes adequate separation of carcasses, parts, and viscera during dressing; routine cleaning and sterilization of certain equipment and hand tools; design and arrangement of equipment to prevent the contact of successive carcasses and parts; and appropriately located, functional lavatories and sterilizers.

This first requirement of sanitary dressing can be more easily met if the slaughter and dressing operations are arranged and conducted on the premise that any one or all of the animals being slaughtered may be diseased or seriously contaminated.

B. When and if contamination does occur, it must be handled promptly and in a manner that insures adequate protection to the remaining product. Any contamination with milk, pus, or pathological tissue or exudate must be promptly removed by trimming and under the direct supervision of an inspector.

Removal of these contaminates must be as complete as possible. Enough tissue must be removed so only clean meat remains. Scraping with the edge or back of a knife, wiping with a cloth or towel, or the use of a water spray are unacceptable procedures for removal of this type of contamination.

Milk is included in the critical category of contamination due to the frequency it contains organisms of public health significance, i.e., Staplylococci, Mycobacterium, TB, Brucella, Actinomyces, etc. Also, many of the lactating animals, particularly cows, are sent to slaughter due to mammary abscesses or other forms of mastitis and all must be assumed to be a source of dangerous c ntamination.

Washing of other contaminants should only be permitted when the contamination is slight and can be thoroughly removed.

The more specific elements of sanitary dressing will be illustrated according to species. Some items, while having primary application for one species, may have value in understanding and applying sanitary dressing procedures to other species.

Since it is impossible to devise specific procedures that will apply in all situations, procedures at variance with those below may be accepted if the purpose of the requirements is fully accomplished.

CHAPTER XXIII

DRESSING OF CATTLE

Stunning and Bleeding

The methods employed in handling, stunning, shackling, and bleeding the animals should be general sanitary practices and humane practices. Holding pens and drive alleys should be kept reasonably clean to avoid soiling the livestock. Overcrowding should be avoided. It may result in animals slipping, falling, becoming badly soiled and even injured through trampling by other stock.

The knocking box, restraining chutes, and holding pens just prior to the knocking box, must be thoroughly cleaned before the start of each day's operation.

Cattle should be dry or be washed clean and dry enough to preclude dripping at the time of stunning. The "dry landing" area where the stunned animals are discharged from the knocking box should be kept clean and dry as possible. If possible, no bleeding should occur in the dry landing area. In those situations where this is impossible, the area must be cleaned free of blood by squeegeeing or washing and squeegeeing between each animal.

It is intended that bleeding occur as soon after stunning as possible so that post-stunning heart action of the animal can be utilized to accomplish more complete bleeding. For this reason and to avoid unnecessary cross contamination between carcasses, excessive numbers of cattle are not to be stunned at one time.

The stunning and dry landing area must be constructed to prevent live animals escaping into the slaughtering department. Loose animals can result in considerable contamination to exposed carcass meat of animals in various stages of the dressing operation. A fence approximately 4 feet high and constructed of rust resistant metal pipe should enclose the dry landing area to prevent the excape of improperly stunned animals.

When penetrating-type captive bolt stunners are used over the frontal region, pieces of skin, hair, and bone are carried into the brain. When used at the base of the skull, they may cause hemorrhage in the area--which requires trimming of the neck after the carcass has been split. The hemorrhagic tissue and the brains contaminated with foreign material are to be condemned.

When lead or frangible-type bullets are used to stun animals, there is frequent penetration of the brain and head meat by bullets and other fragments. Therefore, the tongue is the only part of the head that may be saved for edible purposes.

Certain requirements must be instituted when edible blood is collected. The blood must be collected in a manner that precludes its contact with the surfaces of the animal's body and must not be otherwise contaminated. Collection devices and blood containers must be clean. The collection funnel and knife must be rinsed clean after each carcass and sterilization must be accomplished after each identifiable lot of blood is drawn.

In collecting the blood, the funnel must be placed directly against the carcass and inside the skin edges of the stick wound so that skin contaminants cannot enter the collected blood.

A positive identification must be maintained between the blood collected and the donor animals until such time as all animals in the collection lot have passed inspection. No blood may be saved from any condemned animals.

Prevention of blood clotting can be accomplished by the addition of approved amounts of anticoagulant chemicals or mechanical defibrination.

Mechanical defibrination must not be performed with the hands but suitable metal beaters may be used and must be sterilized between each lot of blood treated.

Head Skinning and Removal

At the time head skinning begins, carcasses must be separated or positioned to avoid contamination of heads or other skinned areas of the neck. The skinned heads should not be permitted to come in contact with other carcasses, the floor, or fixed objects. They should be removed as soon as possible after skinning to further reduce contamination exposure.

The heads should be removed in such a manner to avoid soiling them with rumen contents. This can usually be accomplished by pulling the head sharply to the side as the gullet is cut. Removal of rumen content contamination is extremely difficult because of its finely comminuted character. The head skinner must clean and sterilize his knife frequently and after use on each suspect, retained or obviously diseased animal.

The horns and all pieces of hide must be removed from each head prior to washing. The equipment used for holding heads for trimming and dehorning must be cleaned between each head. Sterilization is required after use on each suspect, retained or other obviously diseased animal.

The washing of heads should be done in compartments or areas which will control the splash of waste water to prevent contamination of other heads or adjacent carcasses. The oral and both nasal cavities should be thoroughly flushed before washing the outer surfaces of each head. Each head must also be free of all hair and other contamination prior to inspection.

Lighting in the head wash cabinet or compartment should be no less than 50 foot candles at the level of the head.

Head hooks in washing cabinets should be removable or effective means for in-place sterilization (including a thermometer) must be provided. Such hooks are to be cleaned between each use and sterilized after heads from each suspect, retained or obviously diseased animal are handled.

Head inspection racks are to be cleaned and sterilized following each use involving a retained head. Since this is impractical to accomplish with hooks installed on a continuous chain, all such installations must be provided with a suitable cabinet or other device that will clean and sterilize each hook prior to its subsequent use.

The minimum hot water sterilization temperature is 180° F. and a conveniently located, easily read thermometer must be provided to determine continual compliance throughout the operation.

Rodding the Esophagus

When cattle are slaughtered by the "on-the-rail" method, the "rodding" of the esophagus (weasand) should take place at the time the head is removed from the carcass. Then the esophagus should be effectively closed to prevent the escape of rumen contents.

"Rodding" usually consists of positioning the looped end of a metal rod around the esophagus and pushing it through the chest cavity as far as the diaphragm. This frees the esophagus from its attachments to the trachea and lungs so that during evisceration it may be pulled through the chest without tearing.

When cattle are slaughtered by the "bed" method, the rodding of the esophagus may be deferred until the animal is positioned on the bed. "Rodding" is required in all situations in which evisceration involves removal of the abdominal viscera independent of the thoracic viscera.

In all cases, the esophagus must be effectively closed and this is preferably done near the bleeding area to minimize contamination of the carcass and the dressing area.

Skinning and Related Operations

After the head is removed from the carcass and while the head is being cleaned and inspected, establishment employees place the carcass on the skinning bed (except in installations where this procedure is not used). Care must be taken to see that the area is acceptably clean before the carcass is lowered.

The head skin must be so manipulated that the tissues of the neck will be protected from soilage and other precautions taken to prevent contamination of any meat of the carcass. This may best be accomplished by leaving the ears on the hide and head skins tied, except in "kosher dressing."

In those situations where the establishment can demonstrate the ability to consistently drop the carcass without contacting the neck to floor, the tie may be eliminated.

The front and hind feet must be removed before any other incision is made in the carcass.

In removing the front feet, care should be taken to expose as little as possible of the tissues of the foreshank and leave a "tie" of the hide completely covering the shank as far down as possible toward the carpal articulation where the cut is made to remove the foot; or the feet may be removed by a single transverse incision through the hide and articulation.

Except for the original incisions for sticking and starting the skinning operations at the poll and shanks, incision into the skin should be made with the knife blade directed toward the hair side of the skin to prevent contaminating the flesh with cut hair.

Cattle should be sufficiently far apart to prevent contamination of skinned parts of adjacent carcasses by skin or hide.

Lactating udders are to be removed in such a manner as to prevent soilage of the carcass with udder contents. Any and all such contamination from udder content must be immediately trimmed from the carcass. Also, udder contents must not be allowed to contaminate walls, floors, or equipment surfaces.

As the skinning operation proceeds, care must be taken so that the outside surface of the hide is continually reflected away from the carcass. Each area should be skinned back far enough to permit the hide to stay in a rolled-back position before the skinner proceeds to another skinning location. On-the-rail dressing operations start with the hind shanks and proceed downward while in bed dressing skinning operations begin at the midline and shanks and proceed downward with the pritch stick handled in such a way as to prevent direct contact with the exposed carcass.

With on-the-rail layouts, the lower skinning should not begin until the carcass has passed the points of common contact, such as hindquarter skinning platforms. Also, in this type of operation the foreshanks may be left on until the brisket and foreshanks are partially skinned. This helps to avoid shank contamination.

When establishment employees move the carcass from the skinning bed, they must use care to see that the exposed parts of the carcass are protected from contact with the floor or other fixed objects. After each carcass is handled, the floor of this area should be maintained in a clean and sanitary manner. Squeegeeing is usually adequate unless pus or other septic fluids are present. If washing is required, it must be done in such a manner that precludes splash contamination to nearby carcasses or product.

In all types of cattle dressing operations, the dropping of the bung should be made a final part of the rumping operation. The perineal skin should be reflected laterally over the anus, leaving the external sphincter muscle intact. This operation is known as "scalping the bung".

The incision into the pelvic cavity to "ring" the bung should be made by a butcher with clean hands and a clean knife.

Prior to evisceration, the rectum is to be tied. The tie must be done in such a manner as to include the neck of the bladder and must be secure enough to prevent urine and fecal leakage.

The tail is to be skinned out without contamination to tail or carcass. Because the tail and switch are highly contaminated with urine and manure, unusual attention must be given to frequent hand and tool washing at this point. This is particularly important when the same butcher performs other tasks involving carcass contact.

After the tail skin is opened, the tip of the tail is customarily secured with a clamp suspended from the overhead spreader and the skin manually pulled free. The tail clamp must be cleaned and sterilized between each use or the tip of the tail ahead of the clamped portion must be removed and discarded.

On some on-the-rail layouts the tail is skinned as the hide is removed by a mechanical puller. Care must be taken in these situations to see that the tail is held secure or otherwise arranged to prevent carcass contamination.

At some point after the hide is reflected from the midline of the carcass, the brisket is opened to facilitate the easy removal of the thoracic viscera. On bed operations this is done while the carcass is on the skinning bed; whereas in on-the-rail layouts, it is usually deferred until all the hide has been removed.

In either case the thoracic cavity is entered and there is no way of knowing if abscesses or other pathological conditions are present. Therefore, the saw or other instrument used to split the brisket must be sterilized after each use.

In male animals, removal of the pizzle (penis) must be accomplished in a manner that precludes urine contamination of the carcass. In bed-dress layouts, this procedure is accomplished while the animal is in the half-hoist position and cannot be permitted in the bed position due to the likelihood of urine leakage.

Evisceration

Prior to opening the abdominal cavity, any contaminants that may be present should be removed from the midline by trimming. In females, the uterus is the first abdominal organ to be removed and special attention must be given to gravid and infected uteri to prevent carcass and/or viscera contamination with pathological fluids.

On viscera truck type operations, after opportunity is given for inspection, the uterus and its contents are to be placed in or removed from the area via leak-proof containers or trucks.

Considerable variation is observed in handling and utilization of the urinary bladder. No matter what the procedures, spillage of urine on the carcass and/or viscera must be prevented.

The actual removal of the viscera from the carcass is a critical phase of the dressing operation. Acceptable sanitary procedure is dependent on skillful knife work in cutting and pulling free the abdominal viscera from the carcass attachments. Care must be taken to avoid cutting or breaking the paunch and intestines.

While occasional dressing accidents can be expected, careless techniques should not be tolerated in this important operation. If contamination of the carcass tissues does occur, it is to be removed by trimming with a knife or cleaver.

At the time of evisceration, ties must be made at the point where the small intestine leaves the stomach and at the point where the esophagus attaches to the paunch. At each of these two named points, two ties should be made about 4 inches apart with the contents being stripped from the intervening portion of the intestine or esophagus, respectively, before the second tie is made so that the tissues can be severed between the ties without any spillage of contents.

In situations where viscera is not saved as edible, the ties may be eliminated if the viscera is handled in a manner that prevents contamination.

The animal is to be eviscerated into a clean truck or onto a clean table. Automated moving tables must be continually cleaned and sterilized under 180° F. water. An easily read appropriately located temperature gauge is required to determine compliance.

Routine use of the viscera inspection truck does not require cleaning with 180° F. water unless it becomes soiled with visceral content or contaminated with purulent material or viscera from a condemned carcass. For example, when a liver is condemned for telangiectasis, "sawdust," unopened abscess, liver flukes, and the like, that does not result in the viscera pan being contaminated with pus or pus-like material, the viscera inspection truck may be cleaned by means of the usual water rinse that is normally made after each set of viscera is removed.

However, to prevent fat buildup on the metal pluck pan or paunch and viscera portion of the inspection truck, it should be periodically cleaned with hot water.

When one of the following conditions exist, the viscera inspection truck should be thoroughly cleaned and sanitized with 180° F. water in an approved area:

A. When ingesta from a cut paunch or intestine or material from the natural viscera openings contaminate the viscera inspection truck.

B. When a viscera inspection truck is contaminated with material such as purulent exudate from a fluke infested liver, pus from an abscessed lung, liver, or other viscera, peritonitis, or pleuritis.

C. When the viscera inspection truck is contaminated with viscera from a condemned carcass.

When a viscera inspection truck is rinsed, the procedure should not result in contaminating edible product or equipment.

When carcasses are eviscerated onto a moving top table, the eviscerator is to wear a clean apron and boots constructed of acceptable material such as rubber or plastic. These boots should be white or otherwise distinctively and exclusively identified and worn only on the table and adjacent boot cleaning compartment. The eviscerator must also have additional footwear to be worn while traveling to and from the work area.

The boot cleaning compartment must be conveniently located and constructed so as to prevent splash of contaminants onto carcasses or viscera. When contamination of the footwear, apron or knife occurs, a thorough cleaning using 180° F. water is required.

Splitting

Prior to splitting, all contamination, bruises, grubs, and tissue damaged by grubs are to be removed from the midline area of the back. This is necessary to prevent spreading of such contaminants to bone and other surfaces by the saw or cleaver.

When splitting is done at the half-hoist position, care must be taken to avoid the neck contacting the floor. Sterilization of the carcass splitting equipment is required after each use on suspect, retained or obviously diseased carcasses.

Large blood clots and bruised tissue must be removed from the neck. All trimming is to be accomplished prior to rail inspection.

Washing of carcasses must be deferred until bruises have been removed and inspection has been accomplished. This delay is necessary to assure the complete removal of excessive contamination, pus, or other pathological exudates.

Washing should be done with warm water and must be sufficient to insure removal of hair, dirt, or other foreign material. Washing is to be accomplished in a manner which prevents splashing of contaminants on other product.

The washing should proceed from the top of the carcass in a downward direction so that contaminants gravitate away from the clean areas. Washing should be completed before shrouding.

Shrouds must be thoroughly cleaned prior to each use. Since drying is not required, there is a possibility that shrouds may become sour or moldy.

Water or brine used to soak shrouds prior to use must be clean. Pins used to attach shrouds to carcasses must be cleaned and sterilized prior to each use. Wet shrouds that are not used immediately should be kept under refrigeration.

CHAPTER XXIV

DRESSING OF SWINE

Stunning and Bleeding

Sanitation in the livestock holding pens, drive alleys, restraining chutes, and stunning areas should be consistent with those requirements outlined for cattle.

Sticking must be done properly to insure complete bleeding and to prevent shoulder wounds that become heavily contaminated during scalding, dehairing and polishing operations. Animals should not enter the scalding tank prior to death.

Scalding

The scalding tank must be drained and cleaned daily. Fresh clean potable water must be used at the start of each day's operation. Some of the factors influencing effective scalding include water circulation and temperature, number of carcasses, and time carcasses remain in the tub.

The temperature of the scald water should be adequate to insure clean carcasses. (Optimum scalding temperature is usually considered to be 138° to 140°F. but may vary with some facilities.) If additives are used in the scald water, they must be approved.

Carcasses should remain in the scald tank only a sufficient time to loosen the hair. Excessive time in the tank or excessive temperature may result in cooking of carcass and breaking of the skin with resulting contamination.

Dehairing and Gambrelling

Dehairing machines must be maintained in good working condition to efficiently remove hair from the animals. The water temperature and number of carcasses through the machine also influence cleaning.

In single unit dehairing machines, clean water must be used continuously. In multiple unit machines, water may be recirculated in the first 2/3 rds. and clean water must be used in the last 1/3 rd. of the unit, or at least for the last six feet.

Hind feet are to be clean of hair and scurf before gambrelling. If hogs are dipped in rosin, nostrils and mouth should be closed by rubber bands prior to dipping.

Singeing, Polishing and Other Cleaning Operations

The singer should be equipped with an automatic cut off and starter switch to prevent burning of hogs when the chain stops. If a polisher is used, it should

be used with a water spray and function properly.

Complete removal of dirt, hair, scurf, and rosin must be accomplished prior to heading. Carcasses are not to be washed after heading and prior to inspection. It is important that the establishment properly clean hog carcasses before any opening is made for dropping the head or evisceration. These requirements are designed to prevent hair contamination of cut surfaces.

Inspectors assigned to cervical inspection are required to inspect carcasses to determine whether they have been properly cleaned. Inspectors can assist the management of establishments by pointing out many of the above factors that influence satisfactory scalding, dehairing, and cleaning. These factors may vary considerably in different installations and with the type of hogs slaughtered; however, given adequate attention, there should be no difficulty in obtaining satisfactorily cleaned carcasses.

Head Dropping and Evisceration

Due primarily to the frequency of abscesses and tuberculosis in the cervical area of swine, the knife or other tool used to partly sever the head must be sterilized after each head is dropped. The inspectors assigned to cervical inspection are responsible for enforcing this requirement. No shaving should be done after the head is dropped.

When necessary to prevent contamination of the carcass or viscera, the rectum must be tied before evisceration. For the same reasons expressed under cattle dressing the brisket knife or saw is to be sterilized after use on each animal. When opening the carcass, the knife should be used in a manner that prevents cutting the viscera or urinary bladder.

Establishment employees should exercise care to prevent cutting of intestines, stomach and gall bladder. Carcasses contaminated by stomach or intestinal contents or bile must be thoroughly cleaned before being presented for viscera inspection.

Those organs excessively contaminated should be condemned. If any part of the carcass is contaminated with pus or other pathological exudate, it must be trimmed under the supervision of an inspector. Contaminated equipment should be washed with cold water prior to sterilizing in 180°F. water.

The viscera inspector should observe the carcasses and, insofar as possible, the methods establishment employees use in handling carcasses and parts. Establishment employees are required to sterilize implements after their use on retained carcasses.

Splitting and Trimming

If there is evidence of abscesses, ham facings are to be removed and condemned. Castration scars, pizzles and related tissue, if present, must be removed. The saw or cleaver used to split retained carcasses is to be sterilized after each such use.

Necks of all carcasses are to be trimmed to remove blood clots. Stick wounds and any other tissue contaminated by scald water must be trimmed or otherwise acceptably cleaned. All areas where there was a break in the skin prior to or during scalding, dehairing or polishing must be effectively trimmed to remove all contaminated tissue.

The necks of hog carcasses may be washed after removal of the leaf and scrap fat. The skimmings from the tank receiving the water from neck washing should not be used for edible purposes.

After the completion of inspection and dressing operations a final wash may be used for the removal of bone dust.

CHAPTER XXV

DRESSING OF CALVES

A new method of calf dressing is rapidly gaining acceptance and use whereby calves are skinned warm at the time of slaughter. The bloom is preserved and excessive shrinkage is prevented by shrouding each carcass with a disposable plastic shroud before placing in the cooler. This method of dressing results in much cleaner carcasses and its use should be encouraged.

Sanitary dressing procedures outlined for cattle are easily adaptable to this type of calf dressing operation. Since the washing of the hide is not necessary with this system, reference below to hide washing and gambrelling applies to the old style hide-on dressing operations.

Calves are often showered before stunning to aid in hide washing before evisceration. Calf carcasses should be cleaned and dressed while they are suspended from an overhead rail.

Sufficient water pressure, volume of water, and washers must be available to assure complete cleaning of hide and hair. Hide-on calves must be completely clean of dandruff, dirt, and fecal material before heading or opening the carcass begins.

Calves must be spaced on the rail in a manner to prevent contact of skinned head with feet of other calves, and heads are to be removed promptly. The heads are to be thoroughly washed and the cavities flushed in the same manner as cattle heads.

The hide should be opened and skinned back on the hock just far enough to allow insertion of the gambrel. The lower leg with hide attached can then be removed. The front side of the hock should not be skinned until the hide is completely removed.

In general, such procedures as bung tying and evisceration follow the same procedures as cattle for large calves and the same as sheep for small calves.

When an establishment proposes to dress so-called large calves, the adequacy of dressing and cooler facilities should be considered in order to accomplish sanitary handling of the carcass, viscera, and parts, rather than the age of the animal as determined by its teeth or weight. The rail must be so installed as to prevent carcasses, including the heads, from dragging on the floor (minimum clearance 12") or contacting walls, posts, platforms, or other fixed objects that might serve as a source of contamination.

All other dressing procedures, particularly evisceration, must be consistently performed in a sanitary manner.

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The final wash of hide-on calves is limited to the body cavities, the neck, and hide in the neck region. All carcasses with grubs (Hyproderma bovis) skin disease, lice, or other external parasites, as well as those found unclean, must have the hide removed as part of the dressing operations at the time of slaughter.

Hide-on calf carcasses and skinned but untrimmed calf carcasses must be handled at all times to prevent contamination of exposed parts of one carcass by another. At all times includes on the kill, enroute to coolers and shipping docks, in coolers, while being skinned and during shipment. The use of spacing or other protective devices may be beneficial in accomplishing this.

CHAPTER XXVI

DRESSING OF SHEEP AND GOATS

Stunning and Pelt Removal

To avoid contamination problems in the initial stages of dressing, excessive numbers of animals must not be stunned at one time. Since much of the skinning operation involves extensive contact of the carcass with the hands, it is imperative that butchers keep their hands as clean as possible.

In order to prevent contamination of heads, scalping operations should be delayed until the pelt has been loosened from the rest of the carcass. Therefore, skinning operations begin at the hind legs.

Paper should be used on the thigh region on long wool or excessively dirty animals unless the establishment can demonstrate sanitary dressing without paper.

During the "clearing out" operation about one-half inch of skin should be left around the anus, but this skin should not contain any wool or hair. As the pelt is removed care must be taken to prevent contamination of the carcass by dirty hands, knife or pelt.

If a pelt puller is used in such a manner that the carcass is raised to a horizontal position, the carcasses of the female animals must be checked closely for urine leakage. Forceps may be used over the vulva to preclude urine leakage.

Scalping is done after the pelt is loosened from the carcass. Horns should be removed at the time of scalping. Heads that the establishment elects not to scalp must remain with the carcass until inspection is completed. Nasal and oral cavities should be flushed before heads are placed on workup tables or in chutes.

Washing and Eviscerating

Overall washing of carcasses should be accomplished before any openings are made for inspection or evisceration. The washer should take care to prevent filling the rectum with water during washing operations. To accomplish this it is helpful to hold down the tail.

The knife or other instrument used to open the breast must be sterilized after each use.

The bung is not to be dropped until washing is completed. This prevents the pelvic cavity from becoming filled with water. After opening the pelvic area, the neck of the bladder and the dropped bung should be grasped firmly and held until they clear the body cavity. The butcher should then strip a section of gut and remove the bladder and bung.

After removal of the bladder and bung, viscera is to be detached and placed in an inspection pan.

If intestines are to be saved, contamination should be prevented by stripping and/or tying between the large and small intestine before removing from the table and sending down a chute.

A common condition found seasonally in sheep is sometimes referred to as "wild oats" or "needle grass." This plant material has been identified as a specie of Stipa, probably Stipa comata. These needlelike awns penetrate the skin and lodge in the subcutaneous tissue. Localized inflammations are set up around the imbedded plant particles.

When only a few carcasses are affected or the carcasses have only a few lesions of the condition, the foreign material should be removed as a part of the dressing operations in order to avoid extra inspection supervision.

When larger lots of affected carcasses or ones extensively affected with the condition are encountered, the carcasses may be placed in the cooler for chilling prior to removal of the foreign material. Such carcasses must be segregated and held under circumstances that prevent any possibility of their being released before the foreign material has been removed.

CHAPTER XXVII

DRESSING OF HORSES

Loose hair can be controlled by spraying the bellies, legs, and feet with water prior to slaughter. Adequate measures should be taken to prevent contamination of carcasses and viscera with urine.

Hide removal should be accomplished without the carcass contacting the floor or other fixed objects. The evisceration and splitting operation should be performed in such a manner that the carcass does not contact the floor.

All hide and external ear canals should be excised prior to thorough washing and flushing of the nasal and oral cavities.

Equipment used in splitting or cutting the withers and poll regions should be sterilized after each use.

CHAPTER XXVIII

SPECIAL SANITATION REQUIREMENTS AND PROBLEMS

The over-all discussion of meat plant sanitation in this handbook has been divided into many general areas such as plant construction, equipment requirements, drainage, etc., common to all or most plants.

Since it is difficult and cumbersome to attempt to cover all situations and aspects of sanitation, only the more basic guidelines and general requirements of sanitation are presented.

The combined effort of many inspectors has resulted in identifying areas of specific sanitation problems. This section is designed to cover some of these problems not adequately covered in the main body of the handbook.

For convenience, these items, having a broad application, are divided into a general category. The remainder are listed according to the area or type of operation most specifically involved.

General

A. The building, rooms, equipment and other physical facilities of the plant should be kept in good repair and be maintained in an orderly sanitary condition at all times. There should be no handling or storing of materials which create an objectionable condition in areas where product is prepared, stored or handled.

B. Unnecessary pipes, wires, strings, and other material should be removed and no trash should be allowed to accumulate.

C. Scaling paint, dust, and flaking rust must be scraped from overhead structures in edible products departments. Condensation should not be permitted when it can contaminate product.

D. Hot water for cleaning rooms and equipment (other than those requiring 180°F. water) must be delivered under pressure to sufficient convenient outlets and must be of such a temperature to accomplish a thorough clean-up.

Cleaning operations are to be conducted as to minimize the danger of contamination of food and food-contact surfaces.

E. Properly located facilities for cleaning and disinfecting equipment and utensils must be provided. Equipment should also be provided for receiving trolleys, gambrels, sticks, and smoke sticks for transfer to a suitably equipped place for cleaning before reuse.

F. When an inspector decides any equipment, utensil, room or compartment at an official establishment is unclean, a "U. S. Rejected" tag will be attached to it. Such tagged items, rooms or compartments should not be used again until made acceptable and the tag removed by the inspector.

G. When product has become unclean by accidental contamination and can be cleaned with water, care must be taken to see that pieces are promptly washed individually under a spray of running water.

Separate, properly equipped tables, sprays and the like should be provided for this purpose. Use of hand-washing basins for cleaning product is not permitted.

Unclean articles must not be allowed to accumulate before or during the washing operation. Trimming is required in all situations where washing is inadequate in removing contaminants.

H. Control over the use of cleaners, sanitizers, water treatment compounds, pesticides, hog scalds, tripe denuders, and sewage and offal chemicals as handled by the inspector at the time of delivery of these materials into the plant.

These labeled materials must be shown in the "List of Chemical Compounds" booklet. Materials which are not listed should be rejected unless the seller or establishment has a letter of approval from the Laboratory Branch of the Technical Services Division.

Approval letters are intended to permit use of materials accepted during the interim between revisions of the booklet. Therefore, letters dated prior to the date of the current booklet should not be honored.

The procedure for getting compounds approved is shown on page 3 of the booklet.

The appearance of a compound in the booklet is assurance that it is chemically acceptable for use as indicated. The practical use of it is the responsibility of the inspector.

If there is any question concerning a material listed in the booklet, a sample of it should be sent to the Laboratory Branch, Technical Services Division, Consumer and Marketing Service, U. S. Department of Agriculture, Box 348, Beltsville, Maryland 20705.

Materials such as paints, lubricants, and other miscellaneous preparations which are not listed in the booklet and which do not belong in categories A to Z may be used provided the inspector has sufficient information to assure safety and usefulness of them. If such information is not available, samples should be submitted to the appropriate laboratory.

I. Sanitizing agents must not be used as a substitute for thorough and effective cleaning. Residues must be removed from edible product equipment by thorough rinsing with clean water before the equipment is again used for handling product.

However, residues of the compounds need not be washed from floors, walls, and ceilings unless, in the judgment of the Officer in Charge, the presence of such residues is objectionable.

The strength of the solution of quarternary ammonium compounds customarily used does not exceed one ounce of the 10 percent aqueous solution, or one-tenth ounce of the dry chemical to four gallons of water.

Avoid bringing the concentrated solution or the dry chemical into contact with the eyes or nasal passages because of the extremely irritating effect on mucous membranes.

Solutions of sodium hypochlorite and chloramine customarily used do not contain more than one-half of one percent available chlorine (5,000 parts per million).

Solutions containing approximately 50 ppm of chlorine, iodine, or quarternary ammonium compounds may be used as a rinse, after washing, for the hands of employees handling meat food product.

Solutions containing approximately 200 ppm of chlorine, iodine, or quarternary ammonium compounds may be applied to equipment which comes in contact with meat or meat food product. It will not be necessary to remove product from the room when these solutions are used but care should be taken to avoid contact with the product. Equipment should be rinsed with clear water following the use of such solutions. However, rinsing of employees' hands should not be required.

Sodium hypochlorite and Iodophors (aqueous solutions of iodine and certain types of nonionic wetting agents) may be used to produce the chlorine and iodine, respectively.

Use of the sanitizing material should not be permitted to interfere with thorough washing and cleaning of equipment and employees' hands whenever necessary. The beneficial effects of using a sanitizing solution will not be obtained unless the area used is thoroughly cleaned.

Preparations of quarternary ammonium compounds and those of high available chlorine content, such as HTH, chloramine T, dichloramine T, and chlorinated cyanuric acid, should not be stored or used together since such handling may cause fires.

J. Supplies which might contact edible products must be handled and stored under sanitary conditions. Such supplies should be treated as "edible products" and adequate measures taken to prevent dust collection, contamination from footwear, or contact with any unsanitary surface.

K. In some elevator shafts moisture from the threshold of the floor above frequently falls into the trucks of meat being moved on or off the elevator at the lower levels.

A method devised to eliminate this condition has proved very satisfactory. A channel is first cut into the vertical face of the floor support pitched to the corner of the shaft. Then a gutter of heavy steel is attached in the opening with lag screws, and cemented in place. This gutter, being open, can be readily cleaned. It conveys all moisture to a pipe in the corner of the

shaft which discharges into the drain in the pit.

L. Corrosion of galvanized metal equipment may be prevented by frequent thorough cleaning (before corrosion becomes excessive) followed by a light application of colorless, odorless, paraffin oil.

Equipment that is to come in contact with product should be washed before it is used in order to remove excess oil. Such applications of oil are of no benefit on stainless steel surfaces.

M. Since the use of stiff wire brushes to clean metal equipment may result in scratching and injuring the equipment surface, the use of nylon or similar bristled brushes are recommended. Fine wire brushes or steel wool may contaminate product with metal particles, so they must not be used on product, or on equipment that will come in contact with product.

N. Metal trucks and equipment that have been welded should be carefully examined to see that they are free from metal beads and pieces of slag before being used.

O. The use of aluminum should be avoided if possible due to possible staining of product through contact or friction. If it must be used, staining can largely be avoided by the use of anodized aluminum hooks, rails, pipes, and sheets. The anodic coating may erode in time and anodizing becomes necessary to prevent contamination of product.

Use of hard metal hooks, such as galvanized iron or stainless steel or aluminum rails may cause abrading of the rail surface and deposit of small particles of metal on the product.

P. Staples from metal stitching machines represent a dangerous source of contamination. Operation of the machines near open containers of product should not be permitted.

Metal-stapled containers and wirebound boxes of product should be opened with great care.

Livestock Pens

A. To avoid dust and odors, holding and shackling pens should be located outside of or effectively separated from the slaughtering department by full-height partitions of impervious material.

B. The livestock pens must be paved with impervious material, such as concrete or brick, and pitched to suitable drainage facilities. Except at entrances, curbs of at least 12 inches high of impervious material, such as concrete, are to be provided around the borders of the livestock pen area to confine liquids and material.

C. Well-located hose connections must be provided for the clean-up of the livestock pens. Watering troughs should be located over or adjacent to pen floor drains and be equipped with suitable overflow outlets.

D. A reasonable portion of the livestock pens, including the area with the suspect pen and squeeze gate should have a weathertight roof.

Slaughter

A. Slaughtering departments must have adequate floor space and be arranged to facilitate the sanitary conduct of operations and the efficient performance of the inspection.

Truck ways over which products are conveyed from the slaughtering department to other rooms, (such as the offal cooler, the edible products tank charging rooms, and the inedible products tank charging level) should be located so that the material is not trucked beneath rails from which dressed carcasses and product are suspended.

B. The rate of slaughter is dependent on the ability of the establishment to present carcasses, their viscera, and parts in an orderly and clean manner which permits a complete and efficient inspection at all times and does not create congestion or other objectionable conditions of any kind.

C. A suitable room or space and facilities for washing gambrels, beef hooks, trolleys, etc., is to be provided in a convenient location and an exhaust fan should be installed in an outside wall for dispelling steam.

D. Oil must be drained from trolleys, gambrels, hooks, etc., prior to use. Dipping oils are to be kept free of floating debris and foreign film by frequent skimming to avoid transfer to trolleys, gambrels, hooks, etc.

E. Scabbards, chain belts, and similar devices for the temporary retention of knives, steels, triers, etc., by workers and others should be constructed of rust-resisting metal or other impervious material. They should be of a type that can be readily cleaned and should be kept clean.

F. When viscera inspection trucks are used, a separately drained area about 7 by 8 feet in size is required for cleaning and sterilizing such equipment. These facilities should be located at or near the point where condemned material is discharged from the trucks.

The truck washing area should have walls 8 feet or more in height when placed where splash might contaminate edible product. The floor in the area should be pitched about ½ inch per foot to a drain in a rear corner.

A hose for washing trucks with an ample volume of water at a temperature of at least 180°F. is required in the washing area. The hot water must be obtained from a central supply (rather than by mixing steam and water at or near the hose connection) and a dial-type thermometer with its temperature sensitive element located in the hot water line near the hose connection is required.

G. In moving flight-top inspection tables, a suitable compartment-type flight washer and sterilizer is required at the proximal end of the table. The compartment must be provided with a vent pipe to the outside air. This duct must be constructed of rust-resisting metal and be at least 10 inches

in diameter.

The required therometer must have its sensitive element in the hot water line as it enters the sterilizing compartment. The temperature recording scale must be located so that it can be readily observed by the inspector working alongside the inspection table.

Cold water sprays to remove blood, animal tissues, and fluids from the flights before sterilization are required for the returning flights as the distal end of the table. Additional cold water sprays are also necessary to cool the flights immediately following sterilization.

H. Fountain-type brushes are not acceptable for washing carcasses and parts.

I. Carcass shroud cloths should be thoroughly rinsed following washing to assure the removal of all soap or detergent compound.

J. A properly constructed hide chute should be provided near the point where hides are removed from carcasses. The chute should have a hood of substantial rust-resisting metal with a push-in door closely fitting an inclined metal frame that is self-closing by gravity. A vent pipe at least 10 inches in diameter must extend from the hood vertically to a point above the roof.

If hides are removed from the department by some means other than a chute, the facilities must be designed to create no problems of sanitation.

K. The spreading of hides for inspection in the slaughtering room is not permitted.

L. Hog hair must be removed from the slaughtering room in water tight metal containers at least once a day at the end of the day's operations and hair must either be removed from the plant in a watertight metal truck and disposed of in such a manner as to not create objectionable conditions such as fly breeding or odors or, it can be conveyed to suitable equipment for processing in the plant.

Viscera Separation

A. Suitable facilities for holding edible organs and parts (offal) under refrigeration in a separate cooler or in a separately drained part of a carcass cooler are required. Such areas must be accessible from the slaughtering department without passing through a line of carcasses or through a congested carcass cooler.

B. Since the opportunities for contamination are great, and product is handled at temperatures conducive to bacterial growth, it is important that inspectors of viscera separation operations be especially alert to any condition adversely affecting the prompt, clean handling of warm offal products.

The inspector should be thoroughly familiar with both product and handling procedures. It is important to discourage excessive accumulation of any unworked product. Such products must be chilled as rapidly as possible in

line with good commercial practice.

C. Edible offal should be placed on cages with removable metal drip pans beneath, on suitable trucks provided with similar drip pans, or otherwise suitably conveyed to the offal cooler.

If offal is packed in the coolers, suitable facilities including a table and lavatory should be provided.

D. The paunch emptying table must be constructed of rust-resistant metal. The end of the table should overhang the emptying hopper about 12 inches to avoid soiling the cut and serous surfaces of paunches.

The sides of the hopper should extend vertically below the top of the table at least 3½ feet, and converge to a discharge opening at least 8 inches in diameter. This is necessary for the prompt removal of paunch contents without undue contamination.

E. Cattle paunches and hog stomachs used in the preparation of meat food products must be thoroughly cleaned on all surfaces and parts immediately after being emptied of their contents. This should promptly follow their removal from the carcasses.

F. Heads used in the preparation of meat food products should be split and the bodies of the teeth, the turbinate and ethmoid bones, ear tubes, and horn butts removed; then the heads should be thoroughly cleaned.

G. Kidneys used in the preparation of meat food products should first be freely sectioned and then thoroughly soaked and washed.

H. Many hog tongues are lacerated and soiled during and following the dressing operations. The mutilation is caused in large measure by the action of the beaters of the dehairing machine.

When this condition exists, all lacerations and punctures in the tongues must be removed by excision. Stained mucous membranes must be removed by scalding The trimming of tongues and removal of mucous membranes should be regarded as a part of the dressing operation.

I. Pharmaceutical products should be prepared, collected, and stored in such a manner that no sanitation problem exists. There should also be no interference in the preparation or inspection of edible products.

Inedible and Condemned

A. Well arranged and adequate facilities for handling inedible and condemned material should be provided at slaughtering plants. Inedible products departments must be separate and distinct from those used for edible products, except for one connecting doorway provided with a solid, self-closing door connecting the tank charging room of the inedible products rendering department and the slaughtering or viscera separating departments. The door must completely fill the opening.

B. If rendering facilities are not provided, condemned material should be denatured and held in watertight metal containers in a suitable inedible products room pending daily removal to a rendering plant. Permission to convey such material over public streets and highways must be obtained from the state and local authorities having jurisdiction in such matters.

C. Pipes, chutes, conveyors, etc., used to convey material from edible to inedible departments must be effectively hooded and vented to prevent objectionable odors in edible departments. Inspectors must be aware of the origin, destination, and purpose of all pipelines, chutes and conveyors.

D. Watertight metal trucks, containers or other receptacles must be used for holding and handling inedible or condemned product and should be constructed for easy cleaning.

Such trucks or receptacles are to be properly marked according to regulations and must never be allowed to be used in any manner for edible products. Inedible product containers must be acceptably clean before being allowed to enter edible departments.

E. Tanks, fertilizer driers, and other equipment used in the preparation of inedible product should be properly equipped with condensers and other appliances which acceptably suppress odors incident to such operations.

F. Slaughtering establishments which make inedible animal or fish food from certain byproduct should provide adequate facilities for preparing, denaturing or decharacterizing, chilling, and packing the material separate and apart from facilities used in the preparation of edible products. The material should be denatured or decharacterized promptly as a part of the dressing or viscera-separating operations to avoid extra supervision by inspectors.

After the inedible material has been packed in properly marked liquid-tight containers, it may be stored in the edible products freezer provided it is held separately and does not interfere with handling of edible products.

Processing (General)

A. Meat preparation and processing departments must be of sufficient size to permit the installation of all necessary equipment with ample space for plant operations and truckways.

B. For efficiency, the processing departments should be arranged so there is a proper flow of product without undue congestion or backtracking, from the time raw materials and supplies are received until the finished product is shipped from the plant. Whenever possible, a separation should be maintained between raw and cooked product including the equipment used to handle such products.

C. Facilities for holding perishable product under refrigeration must be provided. For proper care of product and to facilitate control of molds and bacteria, operations such as beef cutting, boning and trimming, bacon slicing, pork cutting, frozen steak preparation, sausage chopping and mixing, etc.,

should be conducted in departments having a temperature not higher than 50°F.

Such operations must be located in rooms separate from carcass or product holding coolers to avoid contamination of product by clean-up water or condensation during the clean-up time.

D. A suitable room or separately drained area must be provided for washing handtrucks, boxes, trays, demountable parts of sausage stuffing equipment, etc.

Two suitable compartments with entrance rails are to be provided for washing smokehouse cages and trees. The first compartment is used for washing cages and trees with a detergent solution and the second for rinsing this equipment with clean water to remove all detergent solution. The washing compartment must have a suitable exhaust duct extending to a point outside of the building.

E. Unprotected light bulbs should not be suspended directly over choppers, grinders, mixers, and similar equipment. Burned out light bulbs should be placed in rubbish containers immediately on removal from the electric fixture.

Special care should be taken in the disposal of fluorescent tubes which may contain a poisonous gas. Such tubes should not be broken in an edible products department of the establishment.

Milk, beverage, and other glass bottles should not be permitted in processing departments. Broken or cracked window panes should be repaired promptly.

F. The inspector must be continually alert to detect substances, such as those contaminated by rodents, insects, molds, and dirt, that are unsuitable for use in food. Often the detection of such contamination does not require a laboratory examination.

When received at official establishments, materials such as seasonings, spices, and cereals have been found infested with insects in various stages of their life cycle. In other instances, infestation has been found after the material has been in storage. It can also occur when fresh supplies are placed in bins or containers that are infested.

Most infestations can be detected by giving these materials a very careful examination before use. However, at some stages (adult, larval, and pupal) the insects are very small and could be easily overlooked so inspectors should frequently send samples to the laboratory. There, a more thorough examination can be made to determine acceptability.

Since some other foreign matter cannot be detected by visual inspection, samples of flour, spice flavorings, curing materials, nonfat dry milk, tomato puree and the like should also be sent to the laboratory for examination.

G. All materials such as curing mixtures, seasonings, spices, tomato puree, cereals, nonfat dry milk, and the like should be enclosed in sanitary containers.

H. No fixtures or appliances, such as tables, trays, tanks, vats, machines, implements, cans, or containers of any kind, should be used unless they are of such materials and construction so as not to contaminate the product. They should also be clean and sanitary.

All steps in the processes of manufacture must be conducted carefully and with strict cleanliness.

I. Inspectors should assure themselves that containers and coverings for product are acceptable for use. This includes metal lard drums which may have a coating on their inner surface.

Slack barrels and similar containers should be carefully examined for wood splinters and lined with suitable material to avoid contamination with splinters.

When paper is used to line containers, it should not disintegrate when in contact with meat and juices. All paper adhering to the outer surface of frozen blocks of meat should be removed before the blocks are cut.

In some cases, copper coated staples have been used in fiber containers. When in contact with meat, these staples cause a green discoloration which should be removed before using the product.

Wooden containers are frequently used in industry for various chemicals and insecticides, some of which are highly poisonous. Containers previously used to hold food may contain vermin excreta and decomposed material consisting largely of food spoilage organisms and dangerous toxins.

As the complete removal of dangerous substances cannot be accomplished with certainty from containers made of porous material such as wood, such containers that show evidence of dangerous contamination should be rejected.

J. Wooden secondhand containers that have been reconditioned prior to receipt at an establishment should not be accepted since it is impossible to give the inspection necessary to determine their fitness for use as contemplated in Section 308.12(a) of the Meat Inspection Regulations.

K. Secondhand containers made of nonporous material, such as steel drums, may be reconditioned without prior inspection. However, inspectors should examine the containers very carefully to determine that effective cleaning and preparation for use has been accomplished.

The inspection would include:

1. Wiping the inner surface of the container with a clean white cloth or towel to determine if all former contents have been removed.

2. Looking for a spotted appearance of the inner surface which may be an indication that the new lining will not adhere over improperly cleaned old linings or rusty surfaces.

3. Looking for dents in rim and sides of drums. These areas should be free from damage that would interfere with satisfactory cleaning and inspection.

In determining the acceptability of steel drums, inspectors should apply the usual product container requirements for cleanliness and absence of probable sources of contamination.

The acceptability of the coating on the inner surface of any metal container can be determined by obtaining from the management the name of the lining material, name and address of the firm that applied the coating, and forwarding this information to the Laboratory Branch of the Technical Services Division, Washington, D. C.

L. Care should be taken in opening slack barrels and other containers closed with nails to see that nails and wood splinters do not enter the product.

In opening burlap or muslin-covered slack barrels care should be taken to completely remove the cloth covering before puncturing the protective paper covering under the cloth.

M. Attaching paper or burlap barrel covers by means of small staples is not permitted.

Staples from metal stitching machines represent a dangerous source of contamination. Operation of the machines near open containers of product should not be permitted.

Metal-stapled containers and wirebound boxes of product should be opened with great care.

N. Cloth, paper, or other containers of meat products or of ingredients such as sugar or spice should be dumped in a manner that lint or dirt on the outer surface of the container will not contaminate the product.

Multiwalled paper bags should have the outer layer of paper removed prior to opening to further reduce the contamination potential.

O. Unclean frozen product should be made clean in an acceptable manner before being defrosted in water or pickle. Care must be exercised to see that no loose material from containers is allowed to enter the defrosting solution.

P. Seafood in official establishments. The evisceration, scaling, cleaning or other similar preparation of seafood should not be permitted in an official establishment unless the areas in which the operations are conducted are completely separate from edible products departments. Such areas must be approved for this purpose and be equipped with suitable and adequate sanitary facilities.

When clean, sound, wholesome seafood is cooked, canned, frozen or otherwise processed in an edible department of an official establishment, the operation must be separate from any meat processing operation. As far as practicable, these operations should be conducted in separate areas and using separate equipment.

However, when equipment is used to process both meat and seafood, such equipment and the area in which it is operated must be thoroughly cleaned before being used to prepare meat products.

Batters, breading mixtures, curing solution and the like which contact seafood may not be used to prepare meat food products.

The sorting of clean, sound, wholesome seafood and the handling as outlined above may be permitted in an official establishment provided the operation does not create a nuisance or interfere with inspection (by reason of strong odor or otherwise).

Q. In some establishments equipment such as grinders, choppers, mixers, etc., are used interchangeably in the handling of pork which possibly contains live trichinae and products that are free of live trichinae.

Necessary precautions must be taken to assure that those products that are free of live trichinae and which will be distributed from the establishment without further treatment will not be contaminated with live trichinae. There must be a thorough cleaning of all such equipment following its use on pork (which possibly contains live trichinae) prior to subsequent use on other products. This can be accomplished by scheduling at the beginning of the day's operation the use of such equipment on products not treated for trichinae.

R. Salt which comes in contact with meat or product should be clean and free from extraneous materials, including rock or slate particles normally found in rock salt.

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The commonly used recrystallized or vacuum-pan granulated salt, with or without anticaking agent, is acceptable for this purpose.

Salt solutions used for curing, defrosting, or for wetting cloths prior to application to dressed carcasses should be clear. The salt used to prepare the solutions may contain insoluble mineral matter such as slate or rock particles but should be free from extraneous material which indicates contamination with filth.

Salt should not be soiled during handling. Bins or other facilities for the storage of salt should be constructed in a sanitary manner. They may be easy to clean and protect the salt from contamination of the solutions.

The equipment used for preparing salt solutions should be of sanitary construction. It should also be maintained in clean condition to avoid contamination of the solutions.

S. Sawdust should not be used on benches or equipment or on floors in areas where operations such as grinding, boning, or cutting are being done. Sawdust used on floors of coolers must be clean and free from objectionable odors and should be replaced daily. Only a very thin covering should be used.

T. Vegetables should be stored in bulk in a suitable separate room. They must be handled so as to avoid spreading dust or other contaminants.

Suitable facilities for the preliminary preparation of vegetables for use in product are provided in a location separate from the processing area. Vegetables such as celery and potatoes must be thoroughly washed before being cut.

U. Lye solution for removing the outer surface of vegetables is permitted provided the lye solution is completely removed before the vegetables are processed further.

V. Most establishments preparing product containing beans have facilities for cleaning, picking, or otherwise eliminating unsuitable beans from a lot before including them in a meat food product. Therefore, when lots of beans are received at an establishment having such facilities, the beans should receive a preliminary inspection. They may be brought into the establishment unless affected with a condition such as heavy mold, sourness or weevil larvae, webbing, or refuse which could not be removed by the cleaning procedures.

Beans from an acceptable lot should not be used in product until the cleaning process has removed all foreign material (stones, dirt, weed seeds, and cereal grains) and beans damaged by insects.

Beans less severely damaged by insects (in which the seed coat is slightly affected) and those slightly damaged by frost, weather or disease may be included in product. Broken beans and beans with the seed coat partially or wholly removed may also be included.

Establishments not having bean-cleaning facilities should receive only beans entirely free of defects that make them unsuitable for inclusion in products. All beans should be thoroughly washed before use.

W. Several types of machines used to overwrap cartons of product, such as sliced bacon, luncheon meat, frankfurters, etc., are designed in a manner requiring product in a carton to be conveyed beneath the heat sealing unit before the wrapper is applied.

Inspectors should closely examine such equipment to determine if the construction permits product contamination. If so, the establishment should be required to install a removable rust-resistant metal tray just below the heat sealing unit.

X. The edges of shovels should be ground as often as necessary to prevent the rolling edges from crumbling into product. Cast alloy shovels made of the softer metals require close attention.

Y. Worn can openers, metal cut by friction, broken or worn parts of equipment, wire used to suspend overhead equipment, loose hooks on cooler racks, metal strapping from fiber containers, and broken wire from bacon hangers and belly spreaders are all sources of metal contamination which should be given careful attention.

Z. The pusher bar of some frozen meat choppers feeds frozen blocks of meat to the chopping blade. There is a space of a quarter inch or more between the pusher bar and the bed of the chopper. This space allows the accumulation of product and fluids that can serve as a source of bacterial contamination.

The pusher bar should be removed at the close of a day's operations and thoroughly cleaned. It should be left unassembled and allowed to air overnight.

AA. The feeder screw of most meat grinders is cast, and the center consists of a hollow core. It is very important that close examination be made of such equipment to detect any crack, flaw, or faulty construction that would result in an unsanitary condition.

BB. The hollow arm in some band saws contains a small opening on the top side. This opening allows clean-up water and other contaminants to enter the saw arm and become sour and decomposed. The problem can be corrected by placing a clean-out opening or plug on the lower side of the arm.

Coolers, Boning and Cutting

A. Cooler rails must be placed at least 2 feet from refrigerating equipment, walls, columns, and other fixed parts of the building. To promote cleanliness of product and to protect walls from damage by carcass shanks, it is desirable to place rails (especially header or traffic rails) at least 3 feet from the walls.

B. Metal tag fasteners used to apply numbered identification tags in the slaughtering departments should be removed after they have served their purpose. Other metal tag fasteners, tags, wood and metal skewers, etc., should be completely removed from carcasses prior to cutting or boning.

Tag fasteners that cannot be readily removed from the meat should not be permitted.

C. Cutting boards should be as small as is practical for the purpose. Such boards should be kept smoothly planed and removed daily for cleaning on all surfaces.

For more detailed requirements refer to "cutting and boning boards" listed under the equipment section of this handbook.

D. Mechanical slicing of unfrozen pork jowls, with acceptable inspection by a competent establishment employee of each cut surface immediately after slicing, is required for jowls intended for use in fabricated products or in rendering.

Facilities must be provided for cleaning and sterilizing these mechanical slicers each time they become contaminated. This is usually accomplished either by a cleaning and sterilizing hood that can be lowered over the machine, or the machine itself be rolled into a sterilizing cabinet. When the latter method is used, it is desirable that a second slicing machine be available so production may continue while the contaminated machine is being cleaned and sterilized. The inspector must be assured that this cleaning and sterilizing is being properly accomplished.

Curing and Smoking

A. Curing containers should be constructed of stainless steel or Technical Services Division approved plastics. Where wooden curing vats are used, replacement with more sanitary containers should be accomplished within a reasonable time which is based upon an understanding between the plant management and the Officer in Charge.

Inspectors should give close attention to the reconditioning of wooden curing vats where such equipment is still used. After being emptied, the vats should be flushed with water and removed from the curing department.

All slivers, blisters, badly discolored wood and ridges should be removed from the inner surface of the vat and a smooth clean inner surface should be obtained. The outer surface of the vat should be smooth with the hoops free from corrosion. Badly rusted hoops should be placed with new galvanized or stainless steel hoops.

After the inner and outer surfaces of the vat have been properly smoothed, it should be flushed with clean water and steam to remove particles of wood and dust.

A suitable truck should be used for returning the vats to the curing department since rolling the vats on the floor results in contamination of the outer surface and top of the vat.

Paraffined paper cups have been used to close the bung hole of reclaimed or secondhand barrels and tierces to prevent contamination of the interior.

B. The cages or trees for smoked meats and sausage are to be designed so there is a clearance of at least 12 inches between the product and the floor of the smokehouses and hanging rooms.

C. Frequent examination must be made of multiple needle pickle-injecting equipment. When a needle is missing from the device, a diligent search must be made until the broken needle is accounted for or located.

D. Only clear solutions free from insoluble suspended material or other contamination should be injected into meat for the purpose of curing.

E. Cover pickle that is clear, free of sediment, and does not show evidence of decomposition may be reused.

Pickle which escapes during the pumping of blood vessels or during the mechanical injection of curing solutions may be reused under proper conditions. These conditions include sanitary collecting equipment and efficient filtration (faint hemoglobin color permitted) before mixing with new pickle.

All pickle lines should be made of stainless steel or approved plastic and those carrying salvaged pickle must be demountable for cleaning at regular intervals.

F. Smoke making equipment, ducts, and smokehouses must be located and designed so all outer and inner surfaces can be readily cleaned.

G. Whenever it is necessary to go through processing departments, sawdust must be conveyed to and ashes removed from smokehouses in metal containers having tight fitting lids.

Sausage

A. Sausage grinder plates of the so-called reversible type are constructed with removable bushings and sleeves. This permits the accumulation of a considerable amount of meat, fat, and meat juices on the inner surfaces of the various demoutable parts during grinding operations. The parts must be completely demounted for cleaning daily.

B. The hollow aluminum emptying plug in some silent cutters has a pan in the bottom and is held in place with small stove bolts seated in the body of the plug. At times, these become loose and disappear. Continued use of the chopper causes the meat juices and particles of meat to get into the plug proper. The pan can be removed leaving the opening which can then be properly cleaned.

The packing nut at the top has a gasket and cap to keep grease out of products. To make this packing nut more secure, cap screws should be used and the thread ends drilled permitting them to be held in place by a wire; this eliminates any chance for metal to get into meat products.

C. Equipment used in the preparation of sausage containing cereal or other permitted materials of similar kind should be clean before it is used to prepare product not containing such additives.

D. Animal casings for use as containers must be thoroughly flushed throughout their entire length before stuffing. Whether this can be done singly or collectively can be determined at the establishment by the inspector.

Animal casings that have been flushed prior to receipt at the establishment and are packed in a salt solution or salt and glycerin solution may be used as containers after thorough rinsing and without additional flushing if found to be acceptable by the inspector. A laboratory analysis for these materials should be requested occasionally.

Materials such as antibiotics, antioxidants, preservatives, nitrite and nitrate are not permitted to be in preflushed casings used at official establishments.

E. One lavatory must be provided for every two sausage stuffing tables and they must be located so as to be convenient to the stuffer operators.

F. Covers to clean out openings of sausage stuffing machines should be removed at frequent intervals and the interior of the stuffers examined to determine the need for cleaning. The frequency with which the covers are removed and the interiors examined and cleaned depends on the kind of product handled.

Particular attention should be given to the interior of stuffers. If particles of meat, fat, liquids, and the like are found, the gasket is worn, defective, or improperly adjusted and permits material to bypass the piston. When such a condition is found, the piston should be "pulled" in order that proper adjustment can be made and the gasket replaced if necessary.

The frequency with which pistons should be pulled depends largely on the condition found on the interior of the cylinder as observed through the clean-out openings and from the top when the piston is in the "down" or loading position.

The kind and consistency of product for which the stuffer is used also has a bearing on the frequency of pulling the piston for thorough cleaning. Thus, a stuffer used for a more or less stiff and coarse product would not ordinarily need to have the piston pulled as often as a stuffer used for a soft or paste-like product, providing the gasket, piston, and cylinder walls are in good condition.

When pistons are pulled, they should be examined for: Any appreciable degree of deterioration of the gaskets or any detached fragments that might find their way into product; accumulation and possible decomposition of product beneath the gasket or in the space between the piston and the cylinder wall; and any other unsanitary condition that might be present.

Attention should also be given to a possible accumulation of product beneath the overhanging edge of the safety ring bolted to the top of the cylinder. Pistons consisting of two (upper and lower) pieces should likewise be given attention at the time they are removed from the cylinder to determine whether any product or material has found its way into their interior.

When compressed air is used to operate a stuffer or other edible processing equipment, an effective filter should be installed as indicated in the equipment section of this handbook. It is desirable that the spent air be exhausted outside the building so fine particles of oil and moisture do not permeate the air in the sausage-stuffing department.

G. Water forced under a linking machine becomes contaminated with the heavy lubricating machine grease that has dropped onto the table from the working parts of the machine.

To prevent contamination of sausage by this grease and water combination, the linking machine should be placed in a stainless steel pan at least two inches deep.

If the possibility of contamination of products by lubricants exists with this or any other machine, the establishment is required to take suitable corrective measures without delay.

H. The sprays in Jourdan-type cookers may be arranged so water strikes the roller assembly of sausage cages or smoke trees and washes grease or oil down onto the product and into the water reservoir at the bottom.

To correct this condition, the sprays may be lowered, or a splash shield may be placed on both sides of the rail and extended down from the top of the cabinet a sufficient distance to prevent the rollers from being sprayed with water.

Canning

A. Containers must be cleaned thoroughly immediately before filling. Precautions should be taken to avoid subsequent soiling of the inner surfaces.

Containers of metal, glass, or other material should be washed in an inverted position with running water at a temperature of at least 180°F. The container-washing equipment must be provided with a thermometer to register the temperature of the water used for cleaning the containers.

B. The use of efficient jet-vacuum type equipment has been accepted for cleaning jars and cans before filling in lieu of cleaning with hot water as required above.

The air cleaning method involves the direction of a powerful stream of filtered air into the open top of the upright container immediately followed by complete evacuation of the container by means of a vacuum-producing device. In properly functioning equipment, the air jet dislodges dust, particles of cardboard and other extraneous material and the vacuum removes these materials just as effectively as the conventional hot water cleaning methods.

C. Analysis of various contaminants found on hams in Pullman-type cans revealed the contaminants fell in three areas: small solder splatter pellets; small particles or flakes from the inside can lacquer; and various contaminants and dirt from unclean product or cans.

The tiny solder splatter pellets constitute the minor part of this problem and can manufacturers have been contacted to eliminate or at least greatly reduce this problem in the future. Particles of interior can lacquer might be loosened when the can is placed on the stuffing horn.

Close attention should be given to the condition of the stuffing horn to see there are no sharp rough edges which might cause the lacquer to flake.

The major problem appears to be paper lint or dirt which was not removed from the can in the normal can washing operations. Apparently, can washing facilities designed for shallow cans do not begin to accomplish a thorough washing of the long Pullman-type can. Inspectors are alerted to give this full attention.

If necessary, the can washing facilities should be redesigned to insure a large amount of flushing water to all parts of the can. Mechanical brushing may even be necessary to accomplish the desired results.

D. Some of the known environmental factors which influence the germination and growth of microorganisms include temperature, salt concentration, pH, presence or absence of starch, sugar, nitrate, nitrite, kind and numbers of microorganisms, etc. The relative importance of each factor in relation to the total other factors is not well established.

The numbers and kinds of organisms in cured canned "Perishable" meat items are of great importance. Therefore, the inspector should be particularly alert to see that cured product ready for canning is fully sound and has not been handled in a questionable manner.

Bacon Slicing

A. The stainless steel strips on the base of some bacon slicing machines do not fit tightly, and some fat and meat juices work their way under the strips and become sour or rancid. These strips can be removed and the area under them cleaned. The strips can then be welded to the base with a stainless steel weld which is ground smooth and polished.

The guide rod for the meat holder on some bacon slicing machines has a recessed area at one end in which a certain amount of fat and grease accumulates.

The guide rod should be removed as often as necessary to maintain proper sanitation, and the recessed area should be properly cleaned daily.

Import

A. Facilities required for import inspection should include the following:

1. Freedom from dust, flies, and insects
2. Sanitary rust-resisting metal tables, preferably stainless steel
3. Adequate lighting with a minimum intensity of 50 footcandles
4. Ample supply of water for cleaning and hand washing

B. Facilities for defrosting and inspection of the thawed samples must be provided by the importer in convenient locations. In addition, defrosting rooms must be adequately drained and hot and cold water must be available in the immediate area for cleaning and hand washing.

Rendering and Refining

A. The exhaust or pressure release lines from tops of edible rendering tanks are to be kept in a satisfactory condition and also arranged that condensate, etc., will not drain back into the various tanks after venting.

B. The construction of gate valves used on the lower openings of edible rendering tanks permits passage of a considerable amount of meat tissues, bone fragments, fats, and the like into the valve bonnet. To assure sanitary maintenance of this type of gate valve, the inner parts of the bonnet must be flushed daily. The valves must also be completely dismantled as often as necessary for thorough cleaning and inspection.

Several acceptable methods have been devised for installing openings into valve bonnets for daily flushing with hot water and/or steam. Combination steam and hot water lines may be permanently connected to the bonnets. If this is done, adequate precautions to prevent back-siphonage into the potable water supply are necessary.

Gate valves used for the purpose described above should be provided with similar facilities for daily clean-out and a program of dismantling as often as necessary should be initiated without delay.

C. Salt used to settle rendered fats should be free from extraneous material that indicates contamination with filth but may contain insoluble mineral matter that does not remain in the rendered fat.

Shipping and Receiving

A. Product, as it is distributed from official establishments, must be adequately protected against dust, dirt, insects and the like. The appropriate use of protective covering for product and the use of suitably constructed vehicles aids in assuring that the product will reach its destination in a clean condition.

B. When necessary, to avoid contamination of product with wood splinters and the like, slack barrels and similar containers, vehicles, and cars should be lined with a suitable good quality material such as paper or plastic before packing.

Paper used for coverings, wrappings or linings must be of a kind which does not tear during use but remains intact and does not disintegrate when moistened by the product.

C. Since burlap used without any other material as a wrapping for meat deposits lint on the meat and does not sufficiently protect it from outside contamination, such use of burlap is not permitted unless the meat is first wrapped with a good grade of paper or cloth of a kind which prevents contamination with lint or other foreign matter.

D. Interiors of tank cars about to be used for the transportation of any edible product must be carefully inspected for cleanliness even though the last previous content was edible.

Lye and soda solutions used in cleaning must be thoroughly removed by rinsing with clean water.

In their examinations Program employees must enter the tank with a light and examine all parts of the interior. It is advisable that the light used be battery operated to preclude the hazard of electrical shock. The inspector making such examinations should take care to see that only clean outer clothing is worn. Footwear should be covered with clean cloths laundered between each use.

E. Product is to be loaded only in suitable and clean cars, trucks or trailers. As a minimum requirement the transport vehicle should be constructed to assure protection of the product being hauled against weather and road contamination. The vehicle must be free of objectionable odors and foreign materials such as meat, fat, grease, trash and dust.

Vehicles hauling exposed product must conform strictly to rigid sanitation requirements similar to those of any immediate container. All interior surfaces must be clean and intact and the closed doors must produce a dust proof seal.

CHAPTER XXIX

MICROBIOLOGY

Many of the sanitation requirements and procedures are based on the understanding and application of microbiological principles.

This section of basic microbiology is provided primarily for those with no formal background in microbiology and those who are new in their application of this science to meat plant sanitation. Because some rather broad generalizations must be used, there will be some necessary oversimplifications.

The reader who desires more detailed information is referred to any good public library or the exceptional collection of books available at the Meat Hygiene Training Center.

Biology may be defined as the study or science of living organisms while microbiology limits this science to those organisms of microscopic size. From a food sanitation standpoint, bacteria, molds and yeast are the most important organisms.

Bacteria

Bacteria are small, single-celled organisms belonging to the world of plants. They are universally present in man's environment. Most are beneficial and necessary, some are harmful and destructive. They existed long before man and doubtless will survive him.

As one studies bacteria, it becomes necessary to continually group them in convenient categories according to such things as shape, temperature preference, nutrients required and how they are utilized, ability to produce disease method of using oxygen, etc.

These categories overlap considerably and frequently bacteriologists use characteristics of many groupings in order to accurately describe a single organism. Generally bacteria are considered in terms of their microscopic characteristics, the environment in which they survive and reproduce, and the results of their growth as it relates to man.

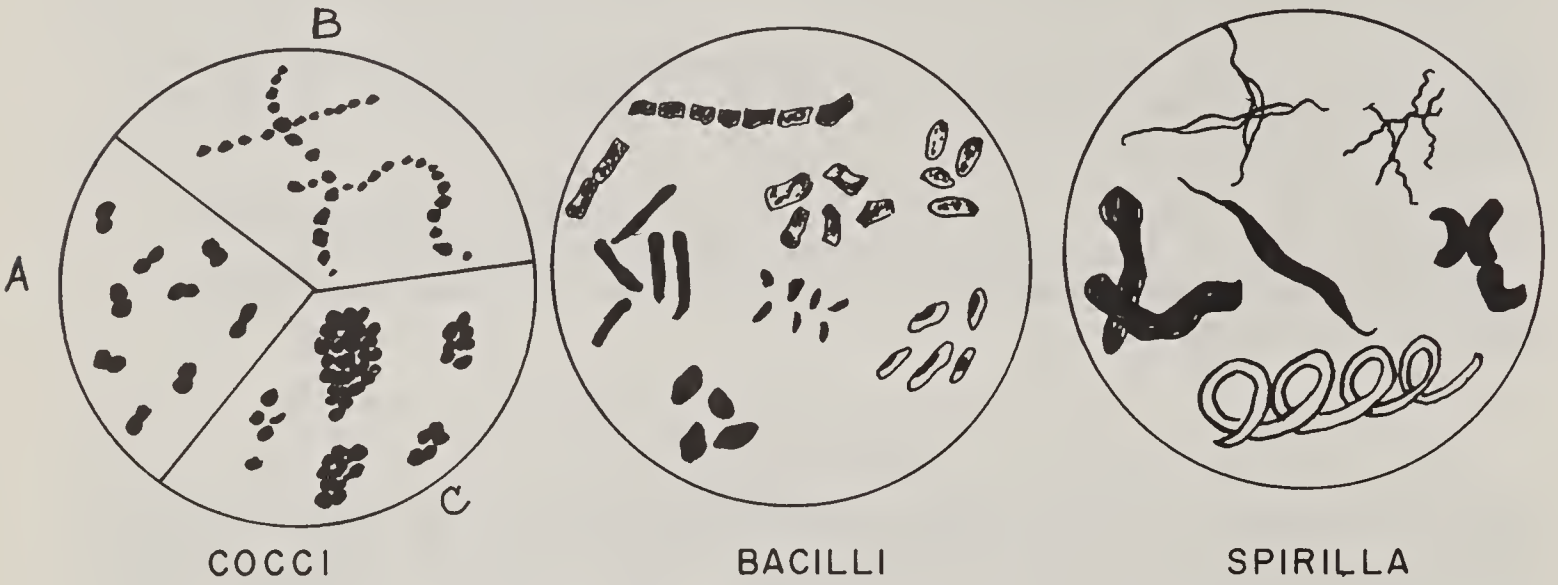
Shape

Bacteria are grouped according to shape into spherical forms known as cocci, straight rods called bacilli, and curved or spiral rods known as spirilla.

Cocci may appear as separate cells or grouped together in pairs called diplococci; in grape-like clusters (such as Staphylocci); in chains (such as Streptococci) or other groupings.

This group contains such organisms as those that cause strep throat, staphylococcal food poisoning, pneumonia, boils, tonsillitis, etc. Some strains of streptococci cause milk souring; some are naturally present in human or animal intestinal tracts.

The bacilli or rod shaped bacteria include organisms responsible for fresh meat spoilage, sausage greening, fermentation in cheese, milk and dry sausage; and diseases such as tuberculosis, anthrax, salmonellosis, and botulism. Many rods are present in human intestinal tracts. The spirilla group include bacteria causing leptospirosis and syphilis, but some are harmless soil or water bacteria



A. Diplococci

B. Streptococci

C. Staphylococci

Size

In dealing with microscopic creatures, one must develop and use new language along with altering concepts of size and measurement. It is relatively difficult to ascribe and comprehend size and measurement on things we cannot see, feel or touch.

The size of microorganisms is measured in units known as microns. A micron, designated by the letter "μ" is equal to 1/1,000 mm or 1/25,000 inch.

The cocci will range from 0.5 μ to 1 2 μ in diameter. The rod-shaped bacilli vary more widely in size than the cocci The influenza bacilli is one of the smallest measuring about 0.2 μ X 0.5 μ. The typhoid organism 0.5 μ X 3 μ represents the middle-sized bacilli while the tetanus bacilli is longer at 0.3 μ X 5 μ.

Some of the largest bacteria are in the spirilla group which vary from 3 μ to 50 μ in length. As a comparison, the human red blood cell is about 8 μ in diameter.

Cell Structure

The bacteria cell is a mass of living material called protoplasm surrounded by a thin cellulose membrane known as the cell wall. The cell wall is often surrounded by a jelly like material called slime. It is this slime layer concentrated by the growth of large numbers of bacteria that results in the visible slime found in such places as on spoiled meat or in contaminated water pockets on equipment surfaces.

When the slime layer on the individual bacterial cell is thick and firm enough to have a form, it is referred to as a capsule. In the case of pathogenic (disease producing) bacteria, the presence of a capsule may indicate that the organism is highly infective.

Motility

Bacteria, like all particles suspended in air or liquid, exhibit a vibrating or oscillating motion known as "Brownian movement." This is not true motility but is caused by bombardment by the surrounding water molecules. Some bacteria in the spirilla group can move by twisting flexing motions of the cell. Many other bacteria are equipped with fine threads of protoplasm called flagella extending from the cell wall which enables them to be actively motile.

BACTERIA with CAPSULES

BACTERIA with VARIOUS TYPES OF FLAGELLA

This motility is severely limited to the organisms' immediate fluid environment and does not permit movement from one location to another as we know it. For such long distance travel bacteria are considered hitchhikers riding from place to place on specks of dust, moisture droplets in the air (as from a sneeze or cough), by hands of workers, equipment surfaces, etc.

Reproduction of Bacteria

When bacteria grow in or on a medium, they tend to form colonies which are masses of bacterial cells usually large enough to be seen without the aid of a microscope.

Under favorable conditions, multiplication and growth of bacteria is a simple process involving cell enlargement followed by formation of a cell wall across the middle and finally separation into two cells. This process is known as binary fission. It may occur very rapidly and under ideal conditions; the entire process can occur in less than 20 minutes.

The time required for binary fission is known as generation time and with each generation the number of cells theoretically doubles. It is estimated that within a 24-hour period one bacterium undergoing fission at its maximum rate could produce bacteria numbering 4,700,000,000,000,000,000,000 and weighing nearly 2,000 tons.

This extraordinary rate of reproduction is only theoretically possible.

Factors that inhibit maximum theoretical growth include:

A. Outgrowing the food supply;

B. Overcrowding of cells;

C. As in any population, not all cells will reproduce nor will there be a 100 percent survival of all cells produced; and

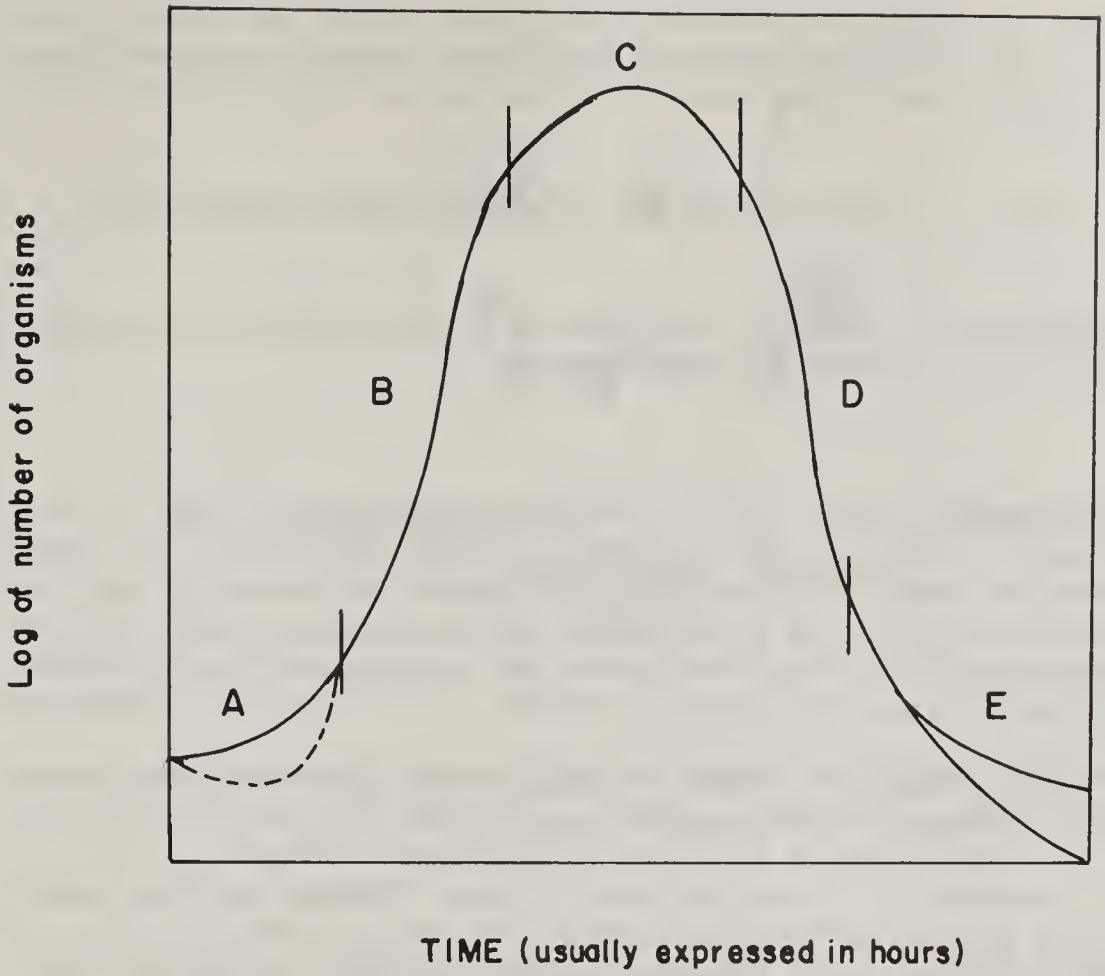
D. The production of acid and other byproducts of cell growth will alter the environment so that it no longer is ideal for growth and reproduction.

But this one example should serve to illustrate that enormous numbers of organisms can be produced in a relatively short time if favorable conditions such as moisture, temperature and food supply exists.

This is important in food production and handling operations and the related sanitation programs. The presence of a few organisms may have serious consequences. Sausage fresh out of the smokehouse may look good but the next day can look bad. Just a few successful bacteria and the proper environmental conditions can make the difference.

When carefully observed, the growth of a bacterial culture follows a definite pattern that can be graphically plotted into what is known as a growth curve (see illustration).

On the growth curve, bacterial numbers are expressed in logarithms as this allows the use of very small to very large numbers on the same chart as each log number represents ten times more than the previous number (1, 10, 100, 1000, 10,000, etc.)



Bacterial Growth Curve (at a constant favorable temperature)

A. Lag phase - or phase of adjustment

B. Growth phase

C. Resting phase (or crisis phase)

D. Death phase

E. Phase of readjustment

The lag phase: This is the time utilized by bacteria to become adjusted to their new environment and there is little or no multiplication. There may even be a reduction in bacterial numbers before the adjustment is made.

The growth phase: During this phase, bacteria undergo their maximum growth rate and it is during this period that the fantastic increase in bacterial numbers appear. In this phase, meat will develop grossly detectable signs of spoilage and actually be decomposed before it is ended. Therefore, the packer is in a sense racing with time to get his product to the consumer before the growth phase sets in. Factors influencing this race will be considered later.

In food spoilage, only the lag and growth phases are important.

The resting phase: At this time bacteria are dying about as fast as they are being reproduced. The factors mentioned above that inhibit maximum theoretical growth begin exerting greater and greater influence at this and subsequent phases on the curve.

The death phase: This is an acceleration of the downward trend begun in the resting phase.

The phase of readjustment: This is the time in which organisms that may survive become readjusted to their new environment.

Spore Formation

The bacterial cell while in the active growing, reproducing state is said to be a vegetative cell. When certain conditions exist, some types of bacteria form strong refractive bodies called spores. Spores are actually the protoplasm of the vegetative cells in a concentrated or condensed form and are formed by well-nourished cells as conditions for vegetative growth become gradually unsuitable (during the resting phase).

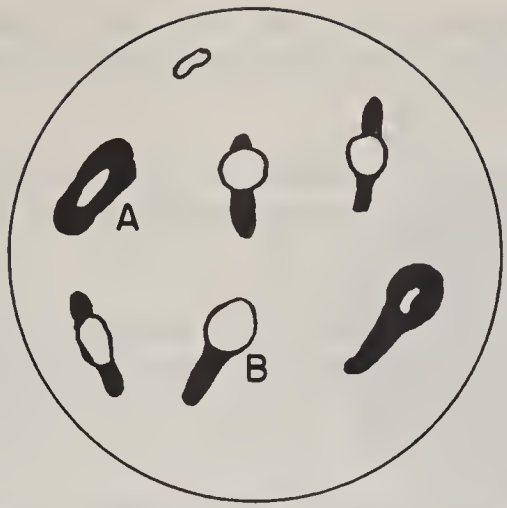
Spores are much more resistant to heat, drying, chemicals, freezing, etc., that would normally damage or destroy the vegetative form of the bacteria.

Spores can remain dormant for long periods of time. Viable anthrax spores have been recovered even from Egyptian mummies preserved centuries ago. Some of the more commonly known spore formers include botulism, tetanus, and anthrax bacteria.

Spores can revert back to the vegetative form when placed in a favorable environment such as surgical openings, cuts and puncture wounds or in a can of meat.

Most shelf stable canned foods must be subjected to a very high temperature under pressure in order to destroy any dangerous spores possibly present. The spores of greatest concern in canned foods are those of the botulism organism which when growing in the vegetative state produce a highly fatal toxin (poison).

The incubation period on canned items is required for assurance that the heat process was sufficient to destroy spores. During this period any surviving spores would have time to become vegetative cells and begin the growth curve and lead to a swollen can or show other sign of spoilage.



A. Botulism spore B. Tetanus spore

BACTERIAL SPORES

Environmental Factors

The environment normally determines the types of bacteria present (the flora). This is a very important fact and offers a tremendous safety factor as we are able to change the environment, and thus to a great extent, control or change types of organisms present.

With meat we actually start with a virtually sterile environment in the flesh of a healthy living animal. After the animal is killed, the situation changes rapidly. The natural defenses of the animal (blood, lymph, uncut skin) fail to prevent the entry of bacteria.

Various steps in the processing plant add or distribute the bacteria, or destroy them. Other steps change the environment so their growth (reproduction) is controlled. With each change in the environment, the bacterial flora and their related problems change.

Nutrition. Different species of bacteria have different food requirements which the environment must provide. All bacteria require a carbon, nitrogen and energy source; trace minerals; and abundant moisture for growth. These things are found in abundance in the proteins, carbohydrates, fat, water, salt, nitrate, etc., in meat processing plants. Therefore bacteria have little trouble finding adequate nutrients.

Bacteria have no digestive tracts. Therefore, they secrete enzymes outside the cell wall to break down nutrients to be reabsorbed into the cell. This process is responsible for most of the desirable and undesirable effects of bacterial growth (such as fermentation, putrefaction, etc.).

Since the bacteria must depend on the diffusion of digested material back to them, they must secrete large quantities of enzymes. This means that a relatively small proportion of bacteria, by weight, can make profound changes in a food.

Enzymes have very specific actions and are identified by this action.

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Oxygen. Like all living things, some bacteria need oxygen to convert matter to energy for growth and metabolism but they vary in the means of obtaining it.

Some bacteria require the actual presence of free oxygen such as that found in the air. These organisms are known as aerobes and without this supply of free oxygen they cannot grow.

Vacuum packaging was conceived primarily to inhibit the growth of aerobic organisms. The lack of oxygen may not destroy the aerobic organisms entirely but they become inactive or dormant and if air becomes available again, they will begin growing and reproducing.

Anaerobic organisms on the other hand satisfy their need for oxygen chemically through organic or inorganic compounds in their environment. Therefore, air or free orxygen is not required and actually can be very toxic to them.

Anaerobic organisms, important in meat, thrive in insufficiently heated or perishable canned items, vacuum packaged products, within the interior of sausage and cured meat products, or any other place devoid of oxygen. Anaerobic organisms can cause fermentation, a useful function in cheese, dry sausage, sour milk, etc. They can also be responsible for canned food spoilage and botulism.

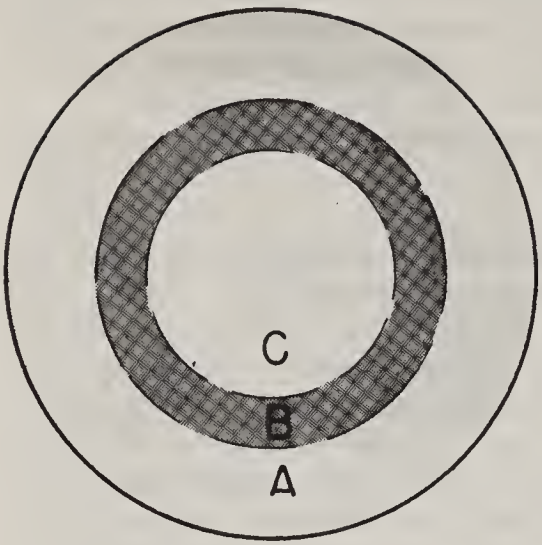
Facultative anaerobes are organisms that will grow either with or without free oxygen. These organisms can cause considerable confusion to the novice.

Certain facultative anaerobes can be a source of one kind of trouble on the surface of product and yet, cause an entirely different problem on the interior of the same or different product. For all practical purposes, the interior portions of fresh meat, hams and other cured cuts, vacuum packages, sausage, etc., do not contain free oxygen and will favor the growth of either the anaerobes or facultative anaerobes.

Many species of facultative anaerobic bacteria play an important role in meats. The sausage greening organism is a facultative anaerobe but producing the green color only when growing in the presence of oxygen.

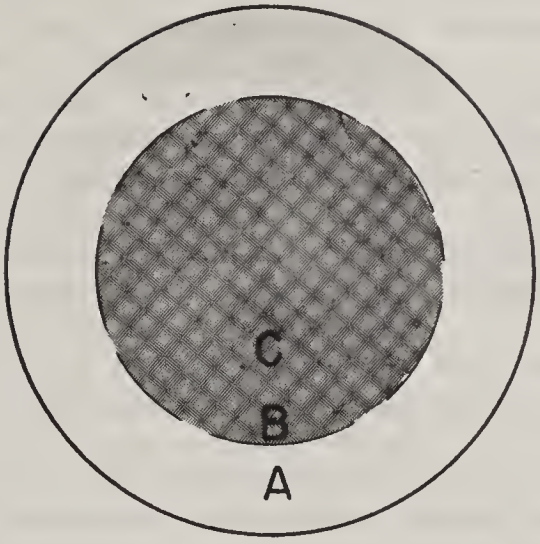
This explains the phenomena of so-called "green rings" which sometimes occurs in freshly cut sausage. The center core is not green due to a lack of oxygen, but turns green after the bacteria (which have been growing anaerobicly) are exposed to air and begin aerobic growth. Adequate heat processing and refrigerated storage will control these problems.

PHASE 1



FRESHLY CUT SAUSAGE

PHASE 2



SAME SAUSAGE AFTER CUTTING & EXPOSURE TO AIR FOR SEVERAL HOURS.

A. Zone receiving most heat treatment; therefore no surviving greening organisms. (Zones B and C received insufficient heat treatment.)

B. Zone of surviving organisms producing green color to the depth that oxygen penetrates the sausage (aerobic conditions).

C. Zone of surviving greening organism but devoid of oxygen, so no green color produced. As seen in II the greening spreads to the center when air is present.

pH (Acidity-Alkalinity). pH is used to express the intensity of acidity or alkalinity. The pH values range from 0 to 14 with the value 7 representing neutrality. Values above 7 indicate alkalinity and those below 7 indicate acidity.

It must be noted that pH values are logarithmic expressions and this means a product with a pH 5 is ten times as acid as one of pH 6 and 100 times more acid then pH 7. The same is true on the alkalinity side, pH 8 is ten times more alkaline then pH 7, etc.

Another observation of importance is that the further away a pH is from 7 the greater significance there is to fractional variations. For example, there is only minor practical difference between pH 6.9 and pH 7.1 but a large difference can occur between pH 4.5 to pH 4.6.

Usually most bacteria prefer a near neutral pH (6.8 to 7.2). Organisms peculiar to meats and meat products are able to grow in a very wide pH range (4.8 to 8.0). The pH of fresh meat is in the range of 5.3 to 6.0, whereas fermented sausage is in the 4.2-5.7 pH range. Some cured products, particularly those using phosphates, may be quite alkaline with a pH as high as 8. Scaled tripe will frequently reach pH 9 or higher.

Each species of organisms has an optimum preferred pH and a definite pH range in which it will survive. Altering the pH has long been an excellent method of food preservation.

High acid foods (those with lower pH values) can be canned without the severe heat processing necessary in low acid foods to avoid botulism danger. Peaches, for example, with pH 4 can be cold packed with safety whereas green beans with a pH 7 must be heated under pressure to destroy possible botulism spores. Botulism spores may be present in both the peaches and the green beans but they are unable to germinate into vegetative cells and produce toxin in the highly acid environment of the peaches.

The pH 4.5 is considered safe for shelf-stable meats and is required on such items as pickled pigs' feet which are canned without retorting.

The acid produced in dry fermented sausage is one of the factors accounting for its excellent keeping qualities even without refrigeration.

Moisture. Moisture is indispensable for bacterial growth as the organisms can utilize their food only by assimilation through the cell wall. This means that bacteria must literally be immersed in moisture and the amount of moisture available determines growth. Control of moisture in, around, and on product is a critical factor in preventing excessive bacterial growth. The air moisture and relative humidity can also affect bacterial growth. Removal of moisture from equipment surfaces, cutting boards, walls, ceilings, etc., can make a significant difference in the bacterial buildup on their surfaces.

In the process of aging beef, the surface must be kept relatively dry to prevent slime and odor which are indicative of bacterial growth. On the other hand, if the surface is kept too dry, there will be an unwarranted weight loss.

Drying and dehydration (moisture removal) represent one of the oldest methods of food preservation known to man.

Other ways of making water unavailable for bacterial metabolism include freezing and the addition of such items as sugar, salt, phosphates and other compounds that tie up moisture. Dried beef, dry sausage, and Smithfield hams are good examples of products preserved by removing and binding up moisture.

Jellies, preserves, and jam are preserved by adding large amounts of sugar which effectively binds the water so there is none available for the bacteria. The sugar in this case goes even a step further. Through osmotic pressure it tends to draw out the water already present in the bacterial cell resulting in the death of many cells.

Moisture can occur on the surface of product in various ways such as dripping condensate, splashing from clean-up or other washing operations, contact with wet surfaces, etc. One commonly overlooked source is condensation on cold product which is moved into a warm moist area. This "sweating" phenomenon is identical to that which occurs on one's glasses when entering a warm area from a cooler or the cold outside air.

Carcasses have been known to quickly lose bloom and begin surface spoilage by being removed from a cooler to a warm dock and back into the cooler. In this

case, the product is not exposed to the warm air long enough to encourage bacterial growth but the immediate condensation on the surface provides the needed moisture for the accelerated growth of bacteria already present and capable of growth at the cooler temperature.

Another similar example may be found in packaged franks which are alternately taken from a cold to a warm environment. The moisture inside the package will condense on the inner surfaces of the package and outer surface of the product and produce a spotty spoilage pattern. This potential is greatly reduced with the vacuum package due to the packaging material being drawn tightly around the product; thus removing the most air from within the package.

Temperature. The temperature at which microorganisms live or die is undoubtedly the most important single factor that concerns their fate. Alteration of the temperature environment through cooking, cooling or freezing is the most effectively and extensively used tool we have in controlling bacterial survival and growth.

Bacteria in general are able to survive throughout an extensive temperature range (-418° to 320°F.). Fortunately, no one specie of bacteria can survive this full range.

In fact, each species has a definite temperature range in which it can survive and within that a smaller range in which it can grow and reproduce. Every organism has an optimum temperature. It is at this temperature that growth and reproduction can occur at its most rapid rate. Based on these characteristics, bacteria can be classified into three main groups:

A. Psychrophiles. This word derived from Greek simply means "cold-loving." Organisms are so classified because they are able to thrive at temperatures below 68°F. and many grow well at refrigerator temperatures 32-45°F. Some of them grow even on frozen foods, down to 10° or 12°F. This does not mean that refrigerator temperatures are optimum or that psychrophiles will only grow in cooler temperatures, it simply means they are capable of growth at lower temperatures.

Psychrophiles nearly always grow more rapidly at higher temperatures (70-90°F.) than they do at the 32-45°F. range. The organisms that produce odor and slime on meat at 40°F. are the same as those that produce odor and slime at 80°F. Only they can do it much faster at the higher temperature. Psychrophilic spoilage below 44°F. is not a hazard to the health of the consumer. (Exception: botulism type E)

B. Mesophiles. These organisms prefer warmer temperatures (70-110°F.) and body temperature is ideal for their growth. This, the largest group of organisms, is very significant because it includes the food poisoning and disease producing bacteria so feared by man. Many mesophiles can survive at refrigerator and freezing temperatures but fortunately most of them cannot grow or produce toxin at temperatures below 45°F.

C. Thermophiles. Organisms classified as thermophiles prefer temperatures from 120° to 140°F. or higher. These bacteria can plague the canning industry as they are difficult to destroy by heat.

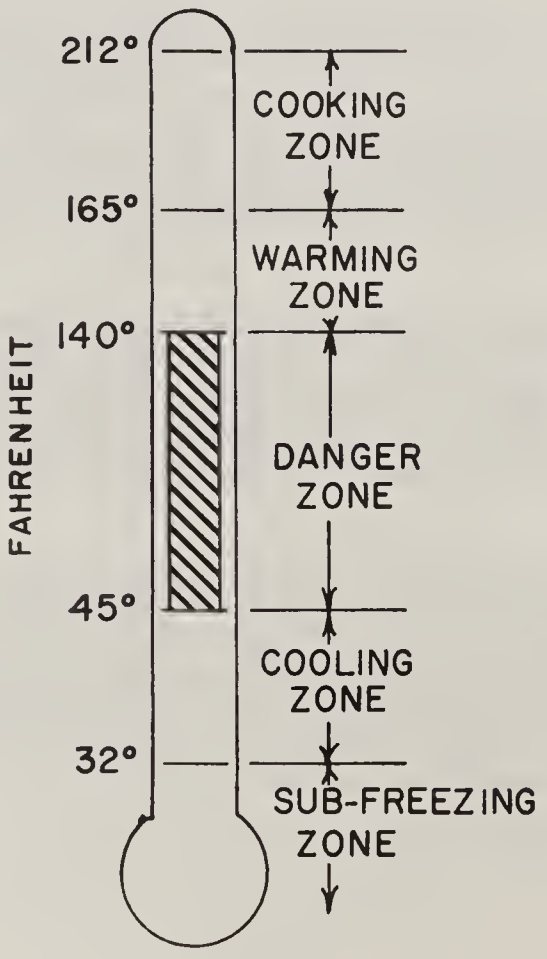
Most heat processed shelf-stable canned foods are referred to as being "commercially sterile"--that is, they contain no organisms capable of growth under the usual storage conditions. If, however, the storage temperature is increased into the favorable growth range of surviving thermophiles, it is possible that spoilage will occur. But thermophilic spoilage is not a hazard to the health of the consumer.

These requirements can be put to good use through careful temperature control. Cold-loving organisms can be destroyed or held in check by heat. Most bacteria of concern in meat will grow at temperatures from approximately 20°F. to 130°F. The fastest rate of reproduction and growth is in the 80° to 100°F. range and is slowest as the temperature drops below freezing.

Temperatures approaching 130°F. will also destroy bacteria and the higher the temperature above this point the more rapid the bacterial death will be. Therefore, product being heated or chilled following cooking should pass through the danger zone (45-140°F.) as rapidly as possible to minimize bacterial growth.

It is important to consider time and temperature together.

Bacteriologists commonly refer to "time-temperature abuse" in connection with product handling. Product exposed very briefly to a 90° temperature is not nearly as abused as the same product held for a prolonged period at 60°F.



Light. Bacteria, even though classed as plants, do not contain chlorophyl and, therefore, do not need sunlight for energy. Diffused sunlight will hinder growth and direct sunlight, especially the ultraviolet ray, is highly injurious to bacteria.

This then becomes one of nature's ways of purifying air and water. Man has also made use of sunlight to purify water (aeration) and to dry foods without surface spoilage.

Ultraviolet light has been used with limited success in some meat operations such as in the rapid aging of beef. Generally the ultraviolet lights are effective in destroying bacteria only within a very few feet surrounding the light.

However, the rays must contact the surface directly. A shadow or a small crease in the surface of the carcass will prevent contact. Ultraviolet rays have virtually no ability to penetrate even thin layers of juices or fat and the glass of lamps gradually becomes opaque to the effective rays. Thus ultraviolet lamps have extremely limited value in practice. (Since the rays are harmful to the human eye, ultraviolet light must be used with extreme caution.)

Salt. Common salt (sodium chloride) in very low concentrations is slightly stimulating to bacterial growth but is harmful in larger amounts. Bacterial species vary in their ability to tolerate salt with some being very salt tolerant and others rather easily discouraged by its presence.

Salt has long been used to preserve meat. With the presence of modern refrigeration in the plant, retail store and nearly every home, salt is used less and less as a meat preservative.

One example of this change is ham which used to be a dry, salty product with good keeping qualities even with little or no refrigeration. The ham of today is very moist and mildly cured by comparison. As a result, it is highly perishable and must be kept under constant refrigeration.

During the cooking process in the smokehouse, products such as frankfurters lose moisture through surface evaporation. As this water containing salt from the cure evaporates, it leaves the surface a little more salty than the product interior. This adds to the keeping quality of the franks by slowing down bacterial growth.

If these same franks are left in the chill--spray cabinet too long, the salt will be drawn out and washed away and keeping qualities reduced.

Yeasts and Molds

Yeasts and molds are both fungi and contain no chlorophyll. They are not in the same classification as bacteria but do have many characteristics in common. Some of the principal characteristics of yeasts and molds can best be summarized in the following ways:

Yeasts

A. Are falcultative anaerobes - they can grow with or without air.

B. Capable of growth at low temperatures and at acid pH.

C. Utilize sugar mainly as a nutrient and are able to convert starch to sugar.

D. May be increasingly important as a meat contaminant.

E. Principally a surface problem (particularly in bologna and franks).

F. Exceedingly difficult to control.

G. Generally not considered harmful.

H. Reproduce by budding.

Molds

A. Are aerobic - they must have air for growth; therefore, they grow on the surface only.

B. Capable of growth at low temperatures (even below freezing).

C. Can grow well in an acid pH (such as fermented sausage).

D. Thrive on meat nutrients particularly the sugar and protein.

E. Are large enough to be seen by naked eye. Appear as white, green, or black fuzzy or hair-like growth. (The "whiskers" on aged beef are molds.)

F. Will grow in the presence of high salt.

G. Will grow in low moisture.

H. Molds are generally not considered harmful. They are commonly found on a variety of processed meat products such as dry sausage, hams, bacon, etc. Molds cannot compete with the common spoilage bacteria found on fresh meat. They usually are not seen unless fresh meat is held for prolonged times in a relatively dry area such as would be found in an aging cooler.

Useful Microorganisms

There are many ways in which microorganisms serve man. Three specific areas of usefulness in meat operations are worthy of brief consideration:

A. Nitrate Reduction. When nitrate is used as a curing ingredient, it must be converted to nitrite before it can combine with muscle pigments to form the pink color, characteristic of cured meats. The conversion of nitrate to nitrite requires the growth of a certain type of bacteria.

For years these nitrate-reducing bacteria were indispensable in meat curing. The processor had to depend upon large numbers of them being present in order to obtain properly colored cured product.

The addition of nitrites directly to product has now gained extensive use and has diminished the importance of these organisms.

B. Fermented Sausage. The "tang" so characteristic of many varieties of dry sausage (Genoa salami, thuringer, Lebanon bologna, etc.) is derived as a direct result of bacterial growth. Certain species of bacteria are capable of converting sugar into various acids. The principal acid being lactic acid; thus these bacteria are known as "lactic acid bacteria."

The greater the acidity (low pH) produced within the product the more "tang" it will have. The sausage maker must be sure the emulsion contains sufficient numbers of lactic acid bacteria to get desirable fermentation and tang. Such sausage is made by either adding a commercially available "starter culture" of lactic acid bacteria or adding enough of the specially handled ground finished sausage to the new emulsion to assure fermentation.

This sausage is then placed in a warm room (often called the "green room") for a period of time to allow the bacteria to begin growing. The fermentation is then completed in the drying rooms.

If the lactic acid bacteria do not get a good start, other types of bacteria may grow instead, causing spoiled--possibly even hazardous--product.

C. Indications of Spoilage. In time, all meat products will spoil, each type in a characteristic manner. This so-called "normal spoilage" pattern is important because it serves notice to the consumer that the food should not be eaten.

Many times the organisms that produce the foul odor, off color, or slimy sticky surface are not in themselves harmful to human health but they indicate that the product has been mishandled or is spoiled and may contain pathogenic organisms or dangerous toxins produced by organisms which may give no gross indication of their presence.

This is one reason why antibiotics are not allowed in meat products. They may destroy the organisms that produce the normal characteristics of spoilage without destroying organisms that would be a threat to human health. In this case, the product may have every indication it is safe and wholesome but in fact may be dangerous or fatal if consumed.

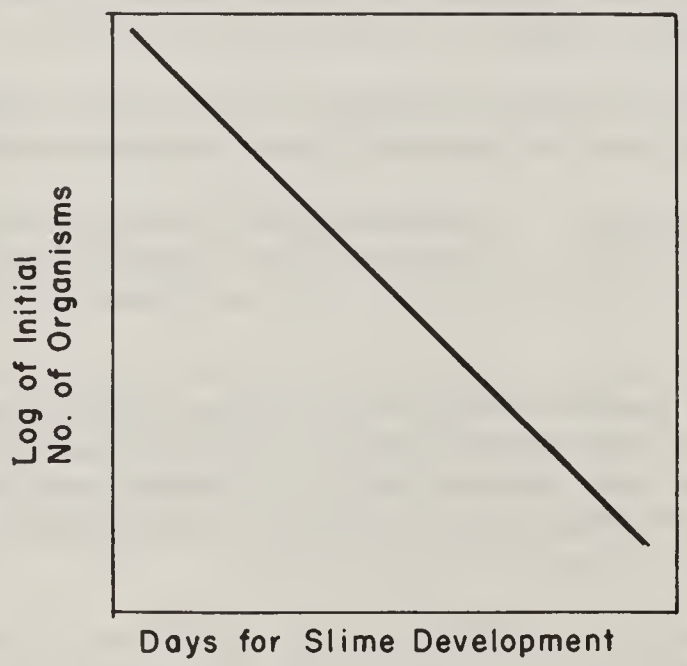
Unfortunately not all dangerous meat or other foods have these gross indicators and may indeed appear normal. This will be discussed more fully in the section on food poisoning.

Factors Affecting the Lag Phase of Bacterial Growth

Understanding the growth curve of bacteria will help the inspector and the plant to improve on product handling and sanitation. Once the colony of bacteria reach the rapid growth phase, it is difficult to avoid the buildup of large numbers of organisms and the undesirable consequences of their growth.

It should be the aim of the packer to conduct all operations during the lag phase of bacterial growth. The following factors will affect the length of the lag phase of organisms in or on product or in the environment (equipment surfaces, walls, ceilings, etc.):

A. Number of Organisms: The initial number of organisms contaminating a surface or product will greatly influence the length of the lag phase. The more organisms present, the shorter the lag phase. Or to put it another way, the more bacteria there are as contaminants, the more rapid the food will spoil. If it is held at a temperature permitting bacterial reproduction, this principle can be plotted graphically. This is an excellent argument for good sanitation aimed at increasing shelf life.



Carcasses being dressed on the kill floor are exposed to potential contamination by very large numbers of organisms. The following approximate bacterial counts for cattle are good examples:

Hide - 3 million bacteria/square inch
Hoof - 100 million bacteria/square inch
Rumen Contents - 53 million bacteria/gram (slightly more than 1/28 ounce)
Feces - 10-100 million bacteria/gram

Other sources of contamination such as workers' hands, clothing, equipment, knives, etc., all add to the initial number of organisms on a carcass entering the cooler. Since the carcass washing process is not 100 percent effective in removing contaminating organisms, sound sanitary dressing procedures must be exercised to minimize contamination.

Number of Organisms/sq. in. present prior to washing	Carcass Washing Number of Organisms remaining according to effectiveness of washing operation		
	50%	70%	90%
100	50	30	10
1,000	500	300	100
1,000,000	500,000	300,000	100,000
10,000,000	5,000,000	3,000,000	1,000,000

Number of organisms/gram present in raw emulsion	Sausage Number of organisms/gram remaining according to effectiveness of heat processing			
	70%	80%	90%	99.9%
100	30	20	10	Less Than 1
1,000	300	200	100	1
100,000	30,000	20,000	10,000	100
1,000,000	300,000	200,000	100,000	1,000
10,000,000	3,000,000	2,000,000	1,000,000	10,000

Another example of the importance of initial numbers of organisms can be found in sausage. The shelf-life of franks (or any other sausage) is greatly influenced by the number of organisms originally present in the emulsion.

The franks will spoil much faster if made with meats of questionable quality, or with excessive amounts of rework products or under poor sanitary conditions than a similar product held under identical post-processing conditions but made with sound, clean ingredients, minimal or no rework product, and under good sanitary conditions. Similar examples can be quickly seen in all phases of meat operations.

The importance of sanitation cannot be overemphasized in maintaining a low level of contamination from microorganisms to insure a more wholesome product with a longer shelf-life.

B. Physiological age of bacterial culture: A closer examination of the growth curve reveals that during the growth phase the bacterial cells are the most active. They are in a sense, physiologically young cells, whereas those cells found in the resting and death phases are physiologically old cells.

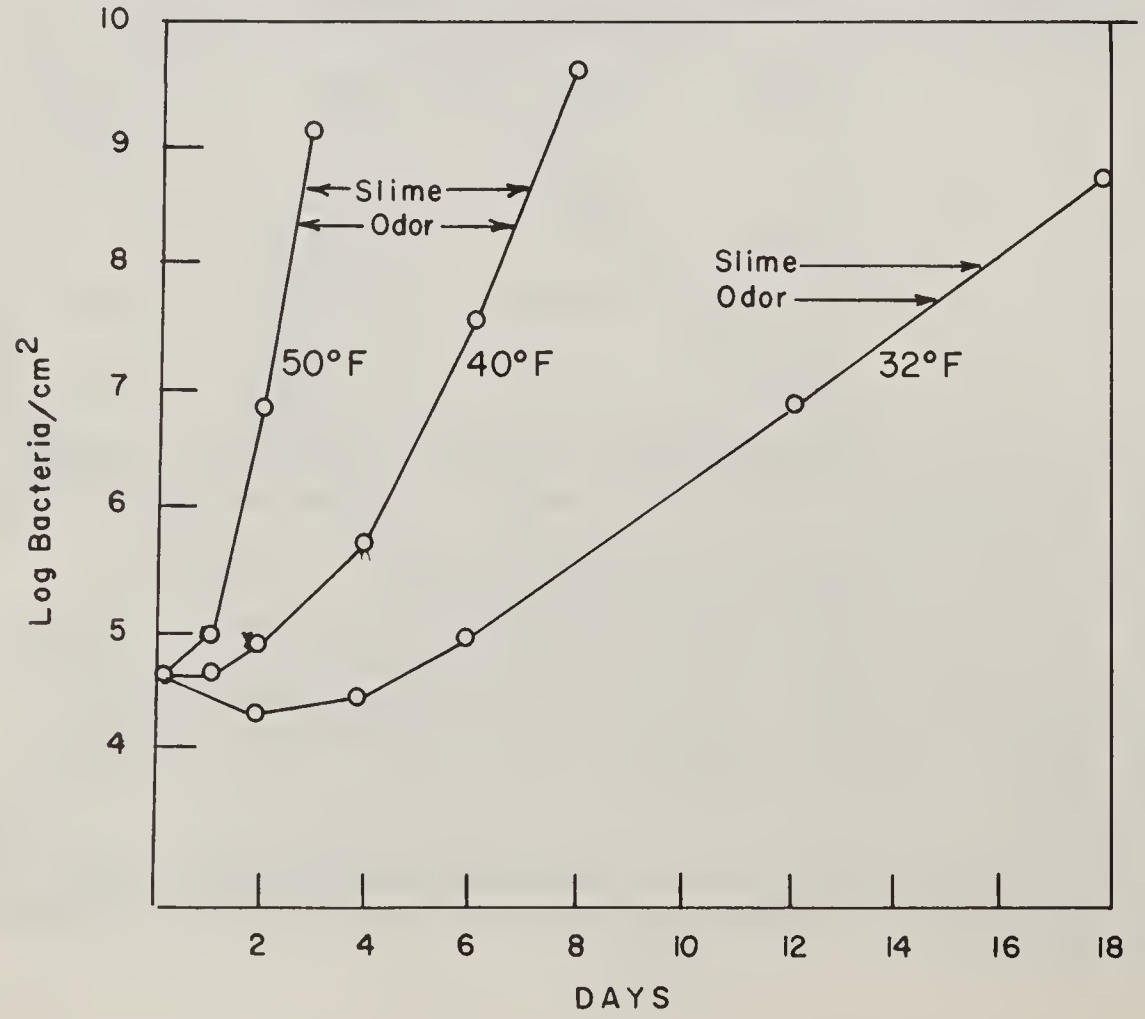
If contamination occurs from bacteria in the growth phase, then the lag phase is considerably shorter than it would be if the cells were from the resting or death phases.

From a practical standpoint, one can conclude that contamination from a slicer is much more important than from the air. The bacterial cells in the air are generally dormant due to a lack of nutrients and moisture while the bacteria on the slicer are likely to be young, active cells in or near the growth phase.

C. Type of Organisms: In meat spoilage, the psycrophiles are the most important group of organisms because by definition they are capable of growth at cooler temperatures. Therefore, when decomposition is the primary concern, contamination from the cooler is more critical than that received from other locations.

D. Temperature: As the temperature drops the lag phase becomes longer. Also the growth rate will be slower in colder temperatures. There is a law of chemistry which says that the speed of a chemical reaction doubles with each $10^{o}C$. rise in temperature. Bacteria can be considered as bundles of chemical reactions.

The following chart illustrates the effect of temperature on the length of the lag phase and the growth rate of a common meat spoilage organism.



A. Fresh meat. The bacterial problems in fresh carcass meat are largely on the surface such as slime, odor, stickiness, off color, off flavor, etc. This is due to the bacteria being limited to the surface areas of the product.

Subsequent operations such as cutting, boning and grinding will introduce bacteria to additional surface areas and spoilage will occur throughout the product and at a much more rapid rate.

B. Cured meat cuts. Cured meat cuts such as hams, briskets, rounds, etc. will have surface and internal spoilage problems. Mishandling of products before curing or subsequent faulty curing and processing cause the majority of problems in items such as ham and bacon.

The curing pickle injected into the product or used as a cover pickle must be handled in accordance with strict sanitation principles. It should be remembered that the longer the time the product is in a cover pickle, the more susceptible it becomes to bacterial problems.

Pumping pickle should not be prepared too far in advance of its use and must be handled in a clean manner.

C. Sausage products. Sausage products have more bacterial problems than any of the other cured items. Sausage is rich in nutrients, contains ample moisture, and is prepared and processed under a variety of environmental conditions favorable to microbial growth.

Not only must care be exercised to see that sausage is prepared from clean, sound ingredients but attention must be given to proper processing methods and sanitary handling following processing.

Time and temperature permitting growth of undesirable bacteria are very important in sausage manufacture. This can result in severe problems of sliming, gassiness, sourness and greening.

The following guidelines are suggested to minimize bacterial problems in sausage:

1. Avoid the use of borderline meats. Sausage making does not in itself improve the quality of the meat. If meats bordering on spoilage are utilized, more finished product problems can be expected. Sausage manufacture is not the place to get rid of meat that is near the end of its shelf-life. Hold rework to a minimum.

2. Avoid lengthy holding periods of product, particularly above 35°F. (This is especially true of uncooked sausage emulsions.)

3. Heat process as soon as possible after preparation. (It is desirable to heat to 156-162°F. internal temperature.)

4. Cool product as rapidly as possible after heating.

5. Store product in temperatures below 35°F., if possible.

6. Strict adherence to sanitation is a must, particularly on that equipment having direct contact with product. After equipment is thoroughly cleaned to remove gross debris, it should be sanitized with an approved sanitizer.

7. All food handlers should maintain high standards of personal hygiene, paying particular attention to frequent hand washing and clothing changes.

D. Canned Meats. Canned meat items fall into two general categories--shelf-stable (commercially sterile) and perishable (semi-preserved).

The shelf-stable products receive a heat treatment severe enough to kill all vegetative cells and kill or damage all spores that might germinate and grow at usual unrefrigerated storage temperatures (95°F. or below).

Since the heat process is not in itself sufficient to destroy all spores, it is important that cans be chilled as rapidly as possible after retorting and that storage temperatures not exceed 95°F.

The nature of canned product, its pH, amount of salt and other curing agents, and the number of spores present, together with retorting time and temperature, determine the degree of commercial sterility and product safety.

The perishable canned meats such as hams and pork shoulder picnics are not considered commercially sterile. They receive only enough heat treatment to destroy vegetative cells. Therefore, refrigeration is required to prevent germination and growth of spores.

The presence of nitrate in the cure helps to assure the outgrowth of putrefactive gas forming facultative anaerobic spores if the product is not sufficiently refrigerated. This leads to a swollen can and product with a foul odor.

Can contents can become re-contaminated in the chill tank following retorting if the closure seal is not perfect. Therefore, only potable water should be used in the chill tanks. Chlorine in chill tank water reduces the possibility of contaminated cans.

CHAPTER XXX

FOOD-BORNE ILLNESSES OF BACTERIAL ORIGIN

One of the most dramatic and feared consequences of bacterial presence in meat product is that of food-borne illness, or as it is more commonly referred to, "food poisoning." Most cases of meat-borne illnesses due to bacteria are the result of contamination and mishandling of meat at some point between slaughter and consumption.

Nowhere can better justification be found for the application of strict, scientifically sound sanitation procedures.

This brief coverage of food-borne illnesses is intended to serve as a review or reminder of the importance of sanitation in preventing food poisoning.

Food-borne illnesses due to bacteria result from three different phenomena:

A. Toxin formation by bacteria growing in the food prior to consumption (such as botulism and staphylococcal food poisoning).

B. Infection due to the growth and reproduction of ingested bacteria (such as salmonellosis).

C. Mechanical damage caused by the release of large amounts of gas produced by ingested bacteria in the intestine (such as produced by Clostridium perfringens).

Botulism

Of all the types of food poisoning, botulism is the most serious, but fortunately it is the most rare. Botulism toxin, the most deadly biological poison known to man, is produced by an anaerobic, spore-forming bacillus known as Clostridium botulinum. This bacterium is commonly found in the soil and must be assumed to be a natural contaminant of foods grown in or on the soil, and a part of the dirt found on the hide and hooves of meat animals.

There are six known types of Clostridium botulinum recognized on the basis of producing chemically different toxins. Those toxins designated as A, B, E and F affect man.

Botulism toxins are heat labile, that is, they are relatively easily destroyed by heat (176°F. for 10 minutes or 212°F. momentarily). The spores, on the other hand, are very resistant to heat; therefore, nonacid shelf-stable canned foods must be subjected to rather high temperatures reached through the use of pressurized cookers (retorts).

The preventive measures for botulism types A and B that were recognized many years ago are still the most effective today. They are:

A. Heat processing of canned foods in conformance with the standards of the National Canners Association.

B. Acid-preserved foods must have a pH no higher than 4.5.

C. Refrigeration of perishable foods at temperatures below 50°F.

D. Good sanitation practices designed to hold spore contamination to a minimum.

The prevention of type E botulism presents new problems. The type E botulism organism is known to be widely distributed in sea and lake mud, silt, water, and similar environs. Therefore, almost all cases of this type of botulism have been associated with fish or marine animals.

It differs from types A and B in that is is more susceptible to heat; it can grow and produce toxin at low temperatures (as low as 38°F.); and it is able to produce toxin in other than optimum anaerobic conditions.

An outbreak of type E botulism occurring in the United States in 1963 led to the establishment of standards for processing of smoked fish. This outbreak of botulism emphasized another important aspect of product safety, practices designed to extend product shelf-life without preventing Clostridium Botulism growth should be avoided.

It is now generally recognized that vacuum packaging of smoked fish in the United States does not promote the growth and toxin production of the type E organism. Rather, vacuum packaging prevents the growth of the molds and other strict aerobic spoilage organisms which would cause the food to spoil and thus be unattractive to the consumer. This extension of shelf-life may permit the growth and toxin production of the botulism organism.

The safety that vacuum packaged sausage products enjoy in this country is not completely understood but is believed to be due in part to the fact that normal spoilage organisms for these products can grow in the anaerobic environment, thus maintaining the indicators of spoilage.

Curing salts, the low level of spore contamination and good refrigeration from processor through consumer also contribute to this empirical safety.

Staphylococcal Food Poisoning

Staphylococcal food poisoning is the most common of all food-borne illnesses. It is caused by a heat stable toxin produced in the food prior to consumption.

The staphylococcal bacteria are widely distributed. Common human sources of contamination include wounds, abscesses and pustules, sore throats, nasal drippings, hair, etc. Unfortunately, the growth of even large numbers of staphylococci on meat usually does not produce changes in color, odor, taste or texture. This ability to produce dangerous amounts of toxin without creating organoleptic changes accounts for the relatively frequent occurrence of staphylococcal food poisoning.

Staphylococci generally cannot compete with the normal spoilage organisms found on fresh meat. Therefore, problems usually occur only in cooked meats that are subsequently contaminated and further mishandled so as to allow the organisms to grow and produce toxin.

Toxin production can occur when contaminated products are held at temperatures above 50°F. and the toxin production is cumulative. This means that a number of brief abuses can lead to toxin formation just the same as one prolonged exposure. If sufficient organisms are present, toxin production can occur in a few hours on product held at room temperature (70-75°F).

Once present, there is no ordinary culinary treatment sufficient to destroy the toxin which can withstand heat up to 243°F. for 20 minutes.

Ham is by far the most frequent vehicle for staphylococci poisoning in meats. It is usually due to consumer mishandling of product. A number of outbreaks occurred in association with hams following acceptance of the quick-cured, artery pumped pasteurized hams in the mid 1930's. Up until that time, hams had been considered a rather stable item able to withstand considerable abuse and requiring little or no refrigeration. They were dry, salty, and acid products.

The modern hams are moist, mildly cured and near neutral in pH. This, coupled with the destruction of the normal spoilage organisms due to heat treatment in the smokehouse, makes the product a favorable environment for staphylococci growth.

It is important to remember that the staphylococci organism may be present and can grow and produce toxin on other cooked meat product, but ham is more frequently abused and thus more frequently a vehicle of this type of food poisoning.

SALMONELLOSIS

Salmonella food-borne illness is actually an infection within the host's body due to the ingestion of foods contaminated by viable Salmonella bacteria. Salmonella infections occur in both animals and man. In recent years, Salmonellae problems have become increasingly important in the United States and many other countries of the world.

Raw Meat Products

Raw meats from almost all food animals, including poultry, may contain Salmonella. Other foods such as eggs, raw milk, powdered milk, coconut, yeast, and cottonseed flour have also been found to contain Salmonella.

Salmonella was first discovered in meat in 1888. About 1,200 different species of Salmonella are now known throughout the world. While nearly all Salmonella species can cause human illness, they frequently occur in both human and animal intestinal tracts and bile ducts without causing illness (the carrier state).

Since normal meat inspection techniques will not detect the presence of such carriers, the complete elimination of Salmonella contamination of meat is

remote as long as carrier animals are received for slaughter. Good sanitary procedures can, however, reduce the contamination potential in meats.

The transmission of Salmonella to the consumer from raw meats can be prevented by normal household sanitation and cooking, but outbreaks can occur if there is cross-contamination to cooked foods or to those foods consumed without cooking. Thus, the heavier the Salmonella contamination of raw meats, the greater the possibility of cross-contamination.

Every reasonable effort should be made to minimize and/or eliminate fecal and bile contamination of carcasses. It is important that hand washing and equipment sterilization procedures be strictly observed. In those instances where there is reasonable suspicion of heavy Salmonella contamination, special instructions will be furnished by the Technical Services Division of the Consumer and Marketing Service.

Processed "Ready-to-Eat" and "Warm-and-Eat" Meats.

Since Salmonellae are easily destroyed by pasteurization, the presence of Salmonella in unopened packages of heat processed meat products generally means that the products were contaminated after processing or were under-processed. Since these products are often not heated enough in the home to destroy Salmonella, they must be free from these pathogens at the time they leave Meat Inspection jurisdiction.

When Salmonellae are found in such products, C&MS will demand that the producing firm recall the product from market channels and hold the product under U.S. Retention pending evaluation of the facts. Also, a special study may be made of operating procedures to detect the contamination source, and appropriate improvements in sanitation will be required.

The same procedure outlined above for handling suspicious raw meat products will apply to processed products also. Recall request will be initiated only at the Washington level.

Inedible Rendering.

Much attention is currently being given to Salmonella contamination of packing house byproducts such as tankage, meat scraps, blood meal, etc., that are used for animal feed. The rendering process is more than adequate to destroy all Salmonellae present. Therefore, the principle problem in this area is recontamination following processing.

For many years, very little inspectional attention was given to these areas other than from the standpoint of general sanitation, control of condemned and inedible materials, and the prevention of a nuisance in or around the plant. This has resulted in the development and use of rendering equipment that is poorly designed and constructed from a sanitation standpoint and in many older installations the equipment is impossible to effectively clean. Newer and future installations should be designed to correct this problem.

Also of prime importance is the recontamination occurring as a result of workers handling the raw and finished product and/or the use of shovels, trucks, and other equipment for both the raw and cooked products. This should be strictly avoided. Birds, rodents, and insects also can be vehicles of contamination and their exclusion and control is vital.

Other Food-Borne Illnesses

Although there are other bacteria able to produce food-borne illnesses, from a sanitation point of view their prevention and control are so similar to the ones mentioned that further discussion is of little real value.

The following charts will provide a brief summary of the various significant bacterial food-borne illnesses:

CHARACTERISTICS OF BACTERIAL FOOD POISONING

CHART NO. 1

DISEASE AND AGENT	INFECTION	INTOXICATION	SYMPTOMS AND TIME OF ONSET
Botulism *Clostridium botulinum*	-	+	Difficult swallowing, double vision, paralysis of breathing muscles. Two hours to eight days. Mortality 65%
Staphylococcus food poisoning. Certain strains *Staph. aureus*	-	+	Nausea, vomiting, diarrhea, cramps, and acute prostration. One to six hours. Occasionally 24 hours.
Salmonella infection *S. typhimurium* *S. enteritidis*; other *S.* species	+	-	Abdominal pain, chills, fever, diarrhea, vomiting, prostration, and sometimes septicemia. Seven to 72 hours.
Streptococcus food poisoning *Streptococcus faecalis*	+	-	Nausea, sometimes colicky pains, vomiting, and diarrhea. Two to 18 hours.
Cl. perfringens *B. cereus* paracolon sp. *Proteus vulgaris*, etc.	+		Same as Streptococcus

CHART NO. 2

DISEASE	TYPICAL FOODS	SOURCES OF CONTAMINATION	THERMAL DEATH POINT, ETC.
Botulism	Home canned foods, smoked fish in U.S., preserved meat in Europe.	Common in soils all over world. Intestinal tract of animals.	Spore former, very high temp. Toxin destroyed by boiling.
Staphylococcus food poisoning	Bakery goods, ham, tongue, milk, ice cream, etc.	Wounds, pustules, nasal drippings, air.	Killed at 137°F. Toxin not destroyed at 248°F. for 20 minutes.
Salmonella food infection	Poultry, pork, eggs, bakery goods, poultry dressing.	Intestinal tract many animals, flies, roaches, rodents, man.	Destroyed at pasteurization temperatures. (30 minutes at 143°F.)
Streptococcus and other species	Bakery goods, poultry dressing, sausage, leaker canned goods, etc.	Intestinal tract of man and animals.	Destroyed at pasteurization temperatures.
Cl. perfringens	Stewed meat products.	Intestinal tract of man and animals.	Spore withstands boiling temperature up to 4 hours.

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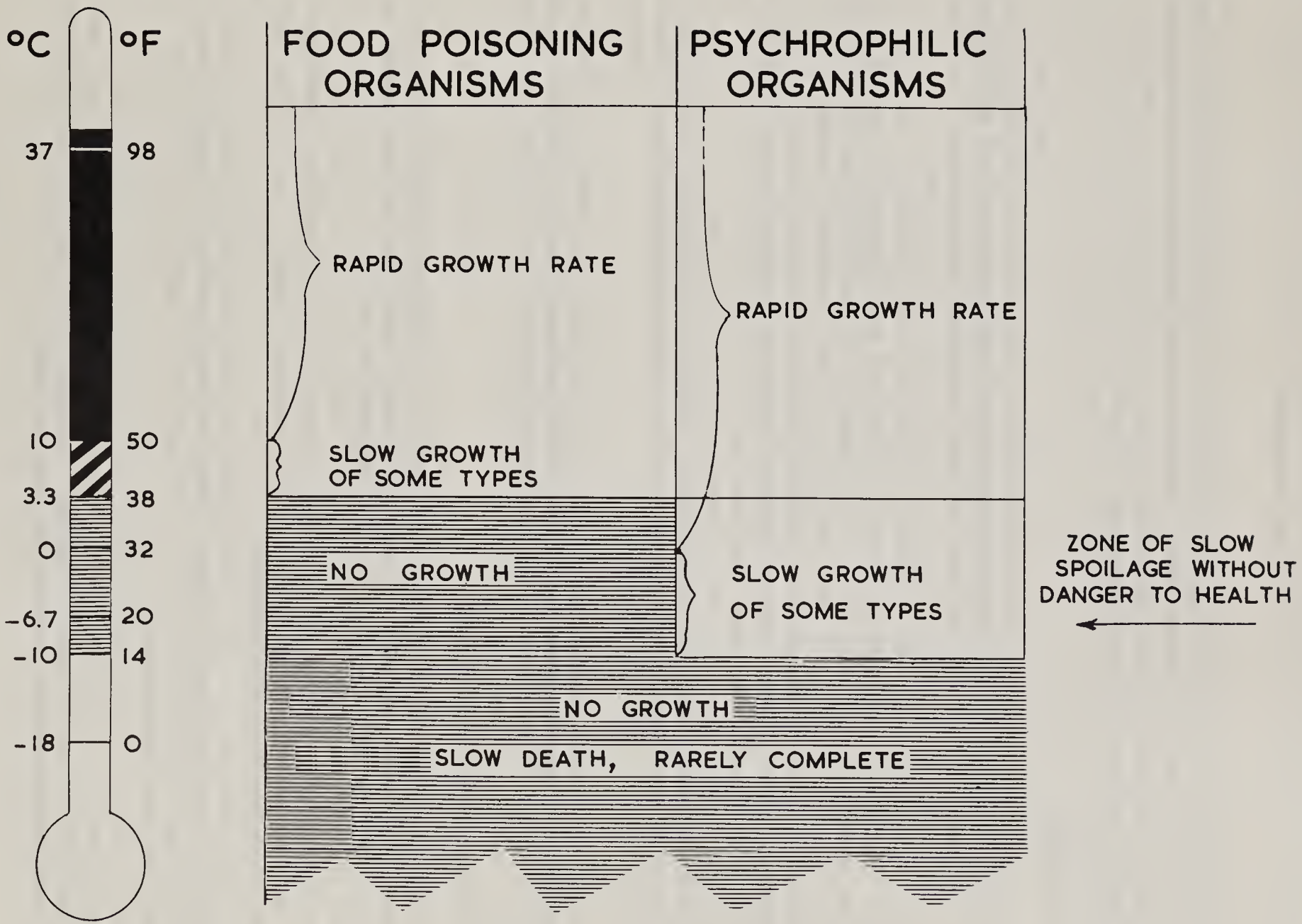
Consistent in the prevention of food-borne illnesses due to bacteria are two cardinal principles:

A. Exert every reasonable effort possible to avoid product contamination. This is especially critical in post-processing handling of precooked products.

B. Proper temperature control. If food is hot keep it hot (above 140°F.); if it is cold keep it cold (below 45°F.) It is important to note that temperatures referred to apply to the product itself and not just the surrounding air temperature.


°C
°F
37
98
10
50
3.3
38
0
32
-6.7
20
-10
14
-18
0
FOOD POISONING ORGANISMS
PSYCHROPHILIC ORGANISMS
RAPID GROWTH RATE
SLOW GROWTH OF SOME TYPES
NO GROWTH
RAPID GROWTH RATE
SLOW GROWTH OF SOME TYPES
NO GROWTH
SLOW DEATH, RARELY COMPLETE
ZONE OF SLOW SPOILAGE WITHOUT DANGER TO HEALTH

CHAPTER XXXI

PLANT PERSONNEL

Clean personnel with clean habits are essential to sanitary production of meat and meat food products. Clean hands, clean clothing and hygienic practices reduce the likelihood of contaminating product and product-contact surfaces of equipment, utensils and packaging materials.

Disease Control

Disease transmitted through meat food products frequently originates from an infected meat handler. A wide range of communicable diseases and infections may be transmitted by food handlers to other employees and consumers through contaminated meat food products and careless handling practices.

It is the responsibility of operators of official establishments to see that no person affected with a disease in a communicable form while a carrier of such disease, or while afflicted with boils, sores, infected wounds, or other abnormal sources of microorganism contamination, works in any area of the establishment where there is likelihood of disease transmission or of meat or meat food ingredients becoming contaminated.

Boils, infected cuts and sore throats are sources of organisms which cause staphylococcal food intoxication, the most frequently reported type of food-borne illness in the United States.

The operators of meat packing plants are also required to assume the responsibility for prompt reporting to local health authorities, all known or suspect cases of communicable disease among their employees.

Clothing and Personal Equipment

All persons handling meat, ingredients, or their contact surfaces must wear clean washable outer garments. Street clothing should not be worn while on duty since it can serve as a source of contamination.

It is required that all workers change clothing daily. In those jobs where there is routine contact of product with clothing (luggers, e.g.), even more frequent changing may be necessary.

All employees working in departments where exposed product is handled must wear caps, hats, hair nets, or other effective hair restraints to prevent hair from falling into the product.

Wearing of loose jewelry should be avoided. Workers are to remove all jewelry that might serve as a source of product contamination during work periods in which foods or components are manipulated by hand.

Wearing of badges, identification cards, campaign buttons, and similar articles on outer clothing by persons who handle products should be discouraged. However, similar articles necessarily worn must be attached so that their accidental inclusion in product is definitely precluded.

Boners' aprons, wrist guards, and the like used as safety devices for employees engaged in slaughter, cutting or boning operations must be of impervious construction and maintained in a clean and sanitary manner.

To assist in maintaining leather boners' aprons in satisfactory condition, a clean, washable cloth covering should be worn over the apron. Use of boners' aprons made of plastic is preferred and encouraged. The cloth covering may then be omitted.

Employees are required to remove all aprons, knives, hooks, and other hand tools before entering toilet rooms.

Cotton gloves, frequently worn by boners, luggers and others may pose contamination problems. Such gloves can be used only in those operations involving inspected and passed products.

In order to assure thorough cleaning, all such gloves are to be laundered in a commercial or establishment laundry. Workers using cotton gloves must begin each workday with a clean pair and make periodic changes throughout the day as necessary. At no time should such use exceed four hours per pair (changing is necessitated due to the accumulations of moisture and contaminants coupled with the worker's body temperature which can lead to a rapid buildup of microorganisms).

Other types of rubber or plastic gloves are commonly worn by various meat handlers. Whatever the type of gloves being used, they should be a light color (not black) so that a ready evaluation of cleanliness and condition may be made. Replacement of such gloves is necessary whenever peeling or other deterioration is observed.

Protective mesh gloves, while not desirable, may be permitted in viscera separation operations and final rail trim jobs if cleaning and sterilization is carried out after obvious contamination. If protective mesh gloves are used by head droppers, bung droppers or eviscerators, they must be covered by intact rubber or plastic gloves.

Footwear should be appropriate to the operation and, in most instances, be of waterproof construction or treated to repel water. Since footwear can be a source of transporting contamination, care should be taken to see that all personnel effectively clean their shoes or boots periodically. This is particularly important when one enters an area less contaminated than the one he is leaving, such as an employee going from the kill floor to boning cooler.

Knife scabbards, belts, steels, knives, hooks and other hand implements are to be constructed so that they can be easily kept clean. All such equipment must be kept reasonably clean during operations and must be completely cleaned at the end of operations.

Cloth or twine wrappings on implement handles and web belts are not permitted as they cannot be properly cleaned.

Cleanliness

The employees of the establishment who handle any product should keep their hands clean.

In all cases after visiting the toilet rooms or urinals or at other times when the hands have become soiled or contaminated, employees should wash their hands before handling any product or implements used in the preparation of product.

Hands often become soiled in the performance of routine duties in and about the establishment so the convenient location of hand washing facilities is essential. Finger nails are not to be polished and must be kept clean and neatly trimmed.

Necessary care should be taken by each employee to prevent contamination of product with substances such as perspiration, hair, cosmetics, tobacco, chemicals and medicants.

Employees should not use tobacco in any form while engaged in food handling or while in equipment and utensil washing or food handling areas. Designated locations in such areas may be approved for smoking provided no contamination hazards will result.

Spitting on the floor is prohibited. Employees must learn to control their hands and avoid unsanitary and unsightly personal practices such as scratching the head, placing the fingers in or about the mouth or nose, or indiscriminate and uncovered sneezing or coughing which is likely to result in contamination of food. The mouth must not be used to temporarily hold tags, pins, cards, or other objects that will subsequently be handled by the employee or directly or indirectly contact product.

The plant management has the responsibility to give establishment employees the appropriate training in proper food handling techniques and food protection principles and shall be cognizant of the danger of poor personal hygiene and unsanitary practices.

All reasonable precaution is to be taken to preclude product contamination by individuals such as those engaged in maintenance and other nonfood handling jobs as well as plant visitors. Employee traffic patterns within the plant should be studied with the view of eliminating or changing those patterns likely to result in needless contamination (the breakdown on employee function outlined in the section on welfare facilities should be helpful).

The area of personal cleanliness is a most difficult field in which to obtain effective action. Bad habits of long standing must be eliminated and rigid rules of personal hygiene and practice must be instituted. It is the responsibility of plant management to set standards in sanitation at a high level and strive to develop attitudes in personnel consistent with the responsibility and obligation to achieve a sanitary food process.

CHAPTER XXXII

WELFARE FACILITIES

Employee welfare facilities include eating areas, locker rooms, showers, toilets, and hand washing facilities. There is a definite inspection responsibility to see that adequate welfare facilities are provided by plant management. The sanitation of employee welfare facilities should be maintained at the highest possible standards.

While welfare and comfort of plant workers are of importance, the basic inspectional interest is to obtain the best possible personal hygiene of the plant workers and the prevention of contamination of product with human wastes.

In addition to vital public health considerations, maintenance of clean, well-lighted, well-ventilated, orderly, and rodent, insect and odor free quarters are also important in that it sets the example to employees of what must be maintained in sanitary, efficient and properly functioning product departments.

Dressing Rooms and Lockers

Well located dressing rooms, properly separated from toilet rooms are required for employees. Separate facilities must be provided for each sex unless only one sex is employed at the plant.

Dressing rooms must be supplied with abundant light and good ventilation. Ventilation exhaust should be to the outside and care taken to see that the air flow is away from product areas.

Lockers supplied for employees should be of suitable metal or other approved construction. They can either be free standing or built-in school type lockers.

To permit cleaning beneath the free standing lockers, they must be on legs or other supports about 16 inches high. These lockers shall have sloping tops at sufficient pitch to prevent top storage of clothing and other items.

It is necessary for built-in lockers to have a positive mechanical ventilation system included as part of the installation and maintained in effective working order. Ventilation of free standing lockers must be provided by doors having lowered openings of adequate size or doors constructed of expanded metal or heavy wire mesh.

To avoid harborage for insects, back-to-back lockers should be separated by a single back partition in common. Those lockers placed against the wall should have their backs eliminated so the wall serves as the back of the locker.

To facilitate orderliness and cleaning of the dressing room, employee seats should be in the form of plastic, wood or other suitable planks about 12 inches wide, mounted in front of and below the doors of the lockers on an extension of the framework supporting the lockers.

If seats not attached to the lockers are preferred, they must be in the form described above and securely fastened by means of a minimum number of pipe leg supports to the floor in the aisle between the lockers.

The aisle width between rows of lockers shall be about 7 feet minimum when attached seats are used (5 feet between rows of seats) and about 6 feet minimum with centrally located seats.

To avoid developing objectionable odors and attracting insects and vermin, all clothing, footwear, personal equipment and the like stored in lockers should be clean and dry. Footwear of all kinds should be stored in lockers or on elevated racks or shelves off the floor and never put away in an unclean condition.

Adequate numbers of appropriately located receptacles must be provided for dirty clothing and trash. An adequate, regular schedule of janitorial service is important in addition to the daily post-operations clean-up.

A plan for routine locker inspection, at least monthly, is imperative. Since many employees routinely keep their lockers locked, a schedule must be established so all lockers are left unlocked for the inspection.

It is recommended that a responsible plant representative take part in the locker inspections so that defects can be pointed out and the security of locker contents assured.

The locker inspection tour should also be utilized to determine if there is an adequate number of lockers and that those in use are in good repair. Lockers needing repair or replacement should be identified to the plant representative and corrective action established. The date, findings, action taken and other pertinent information relating to locker inspections are to be recorded on Form MI-455.

Shower-bath Facilities

Suitable shower-bath facilities should be provided in locker rooms (not in toilet rooms) at establishments where slaughtering operations are conducted. Such facilities may also be desirable in processing plants.

The shower-bath stall must have an 8-inch high curb of impervious material unless it is entered through an individual dressing room that has the floor sloped to drain into the shower. An adequate supply of soap and towels shall be provided. Water outlets should be kept in good repair so as to prevent continued leakage.

Toilet Rooms and Facilities

It is important that a sufficient number of sanitary toilets be provided in convenient locations adjacent to the dressing rooms and other parts of the plant if needed.

Toilet rooms must be separated from adjoining dressing rooms, and other areas, by tight, full-height walls. They shall be so constructed that they do not open directly into rooms or areas where ingredients or products are handled, processed or stored. Entrance through an intervening dressing room or ventilated toilet room vestibule is permissible. Toilet rooms and vestibules must have self-closing doors completely filling the openings.

Adequate ventilation of toilet rooms is also critical because of the possibility of objectionable odors entering production areas. Toilet and dressing rooms, not air-conditioned, should be effectively ventilated mechanically by means of an exhaust fan with a duct conveying the foul air to the outside.

In order to permit free replacement of air removed by the fan, the lower door panel should have a louvered section (at least 12x12 inches). Louvers should be designed to permit only one-way air flow into area. This is required to prevent the flow of foul air into the plant in the event of failure of the ventilation system and during such times that outside windows are used for fresh air replacement.

In the case of air-conditioning systems, there is usually a positive replacement of air within the room; therefore, a solid door is indicated.

Elongated water closets with open split seats should be provided in sufficient numbers for the employees using them. The following formula should serve as a basis for determining the number of toilet bowls required:

Persons of same sex	Toilet bowls required
1 to 15 inclusive	1
16 to 35 inclusive	2
36 to 55 inclusive	3*
56 to 80 inclusive	4*
For each additional 30 persons in excess of 80	1*

*Urinals may be substituted for toilet bowls, but only to the extent of one-third of the total number of bowls stated.

In toilet rooms for men, it is desirable to provide urinals which must be installed so that urine contamination of the floor area is avoided.

If stall-type urinals are used, a step-up of concrete or other impervious material surfaced with ceramic or glazed tile sloped to drain into the urinals must be provided. If wall type urinals are used, properly sloped floor drains must be provided immediately beneath such fixtures.

Conveniently located wall mounted tissue dispensers must be provided and maintained so they remain functional and contain an adequate supply of tissue. It is important that tissue be available without the user being required to handle the tissue roll.

Rigid standards of sanitation must be maintained in toilet rooms. Special attention must be given to insure that toilets and urinals are clean and functional at all times. Blockage of toilets or urinals dictates immediate rejection. If the floors become contaminated with human wastes, the entire room must be rejected for use until a thorough cleaning and sanitizing is accomplished.

Inspectors having responsibility for toilet and dressing rooms for plant employees of the opposite sex should make arrangements with plant management for routine, daily and other inspection of these areas.

Sufficient pedal-operated handwashing facilities in or immediately adjacent to the toilet room are vital to good personal hygiene.

In small plants with a limited number of employees, lavatories in welfare areas may be confined to toilet rooms. However, large dressing rooms should have handwashing facilities in addition to those located in the toilet rooms. These facilities should be reasonably adequate for the number of personnel involved.

It is essential that an adequate supply of hot and cold water, liquid soap in convenient dispensers, disposable towels, and waste receptacle be provided.

Signs directing employees to wash hands prior to returning to work should be conspicuously located.

Lunch Facilities

Lunches, meals, snacks, and beverages (including coffee) must not be consumed in product handling areas. This is essential due to the risks of product contamination and to preclude other insanitary conditions usually associated with eating.

Adequate lunch facilities consisting of readily cleanable tables and chairs (or benches), a lavatory, and drinking fountain must be provided when plant cafeterias or nearby eating places are not available.

If dressing rooms have sufficient space without congestion, no objection will be made to providing the lunch facilities in such areas. Otherwise a separate room or area is required.

Food and beverage dispensing machines within the plant are to be located in the specifically designated eating areas. Machines must be located on elevated racks away from the wall to facilitate cleaning and preclude harboring vermin.

Eating areas must be provided with adequate waste disposal baskets and be policed and cleaned after each use. Janitorial service adequate to maintain reasonable housekeeping and sanitation must be required.

Disposable food and beverage containers such as paper cups, wrappers, bottles and cans should be discarded in waste containers provided near dispensing machines or in eating areas and should not be carried into product handling areas.

When plant cafeterias are provided, they must be constructed and maintained so they can be easily cleaned and should not, in any way, cause a nuisance.

Plant cafeterias are usually considered to be under the local or state health agency having jurisdiction in public eating establishments. Local health codes and ordinances set the standards expected for equipment and handling of food.

Plant management should be concerned that food preparation and handling in these areas meets high standards because to the plant employee the company cafeteria may well represent his view of management's attitude and goal in food handling. It would be difficult to expect the average worker to set his sanitary standards of product handling higher than those he observes on the food served to him in the plant cafeteria.

Separation of Welfare Facilities According to Employee Functions

Employees working in areas such as the livestock pens, hide cellar, condemned or inedible products departments should have separate welfare facilities.

Particularly in large, multiple operations plants it is desirable to have welfare facilities separated according to the following type of operations:

A. Inedible and condemned products areas include such areas as condemned products department, inedible products department, animal feed department, hide cellar, and livestock pens.

B. Heavily contaminated production areas including kill floors and warm offal departments.

C. Chilled raw products areas including fresh meat coolers, beef and pork cuts, loading dock, formulation room (sausage), pickle cellar, bacon slicing, etc.

D. Cooked products department including packing, precooked dinners, pot pies, sliced luncheon meat, etc.

The above listings are to indicate areas in group A as having the most potential contamination both in total numbers of microorganisms as well as the largest variety of disease producing organisms, but group D areas should be most nearly free of contamination particularly of disease producing organisms.

There is considerable overlapping as one considers each category but this breakdown should serve to indicate the relative differences in contamination potential in the various areas.

The dangers to consumers in product contamination are greatest in category D and least in A. Therefore, intimate association through common welfare facilities increases the risks of dangerous contamination of product and critical production areas.

Inspector's Quarters

A well located inspector's office is required at official establishments and should be situated so that it is not entered through a company office or plant employees' welfare facilities.

It must be supplied with appropriate furniture, including a desk and chairs, a file cabinet, or drawer, a supply cabinet equipped for locking, lavatory facilities, and a suitable clothing locker for each Government employee.

Separate shower-bath, toilet room and adequate dressing room facilities must be provided in the inspector's quarters at establishments where slaughtering operations are conducted and at other establishments of such size that the assignment of several inspectors is required.

The same requirements of construction, maintenance and sanitation required for plant employee welfare facilities also apply to the inspector's quarters.

When inspectors of both sexes are assigned to an establishment, separate dressing rooms and facilities must be provided or other suitable arrangements made with the appropriate Officer in Charge.

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